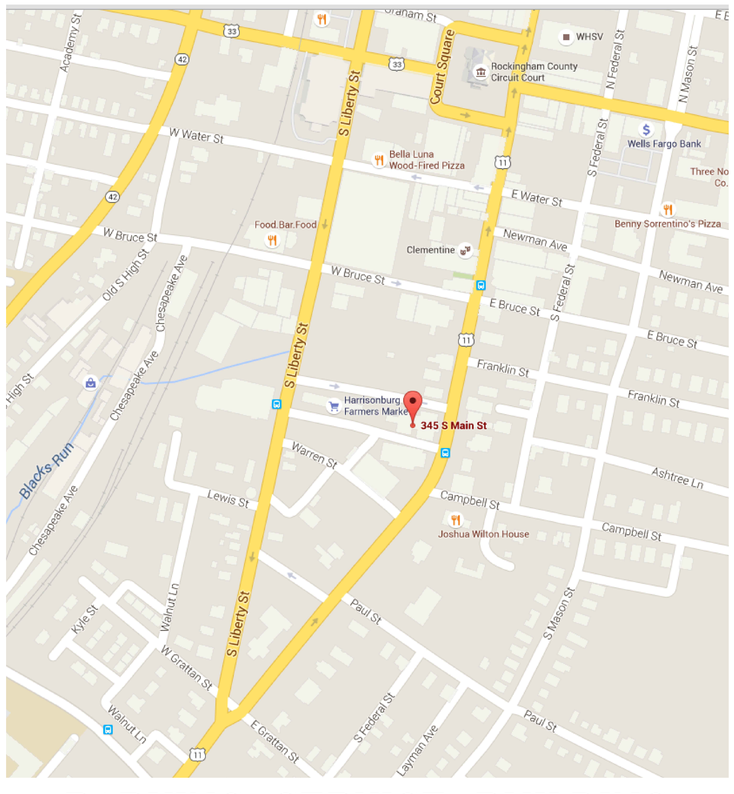
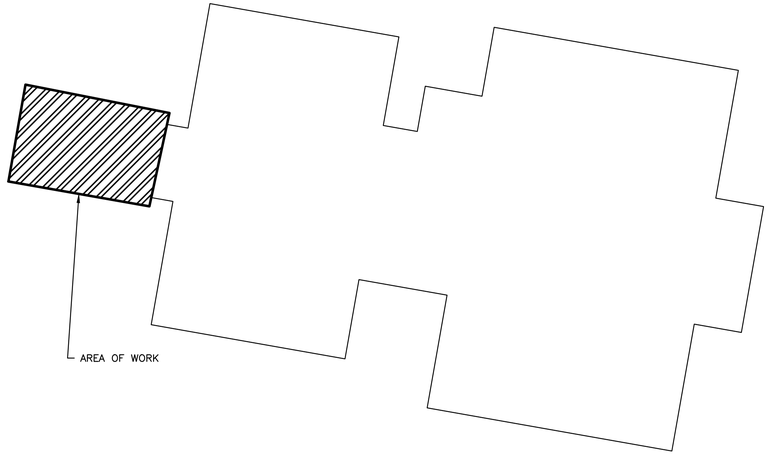
CITY OF HARRISONBURG

HARRISONBURG, VIRGINIA

FARMERS MARKET RESTROOM RENOVATION



PARKING SERVICE BUILDING
345 SOUTH MAIN STREET
HARRISONBURG, VIRGINIA 22801



MEP DESIGN SUMMARY

PROJECT INFORMATION

PROJECT NAME:	FARMERS MARKET RESTROOM RENOVATION
ADDRESS:	345 SOUTH MAIN STREET HARRISONBURG, VA. 22801
PROPOSED USE:	OFFICE AND PUBLIC RESTROOMS
OWNER:	CITY OF HARRISONBURG
OWNER CONTACT:	ADAM WRIGHT
PHONE:	540-560-9455
VE PROJ. NO.:	10895-3

APPLICABLE CODES

BUILDING CODE:	VIRGINIA REHABILITATION CODE: 2012 WORK COMPLIANCE METHOD
MECHANICAL CODE:	VIRGINIA MECHANICAL CODE: 2012
PLUMBING CODE:	VIRGINIA PLUMBING CODE: 2012
ELECTRICAL CODE:	NFPA 70, 2011 NATIONAL ELECTRICAL CODE
ACCESSIBILITY CODE:	ICC/ANSI A117.1 2009 STANDARDS ON ACCESSIBLE AND USABLE BUILDING AND FACILITIES
GAS CODE:	VIRGINIA FUEL GAS CODE: 2012

PROJECT TEAM

PROJECT MANAGER:	PHIL GENTRY
PROJECT TEAM:	JOHN SOLDANO – HVAC ENGINEER MATT SHOCKEY – PLUMBING ENGINEER KEVIN KLINE – ELECTRICAL ENGINEER TED ENOSAKI – STRUCTURAL ENGINEER TIM HOUSDEN – ELECTRICAL DESIGNER

DRAWING LIST

FARMERS MARKET RESTROOM RENOVATION
345 SOUTH MAIN STREET
HARRISONBURG VIRGINIA, 22801

VALLEY | ENGINEERING
IDEAS MADE REAL
3231 PEOPLES DRIVE
HARRISONBURG, VIRGINIA 22801
TELEPHONE (540) 434-4995 OR (800) 343-6365
FAX (540) 432-0685
www.valleycsp.com

CONSTRUCTION DOCUMENTS

REVISIONS:
1 BID ALTERNATE # 1

DATE: 05-17-2016

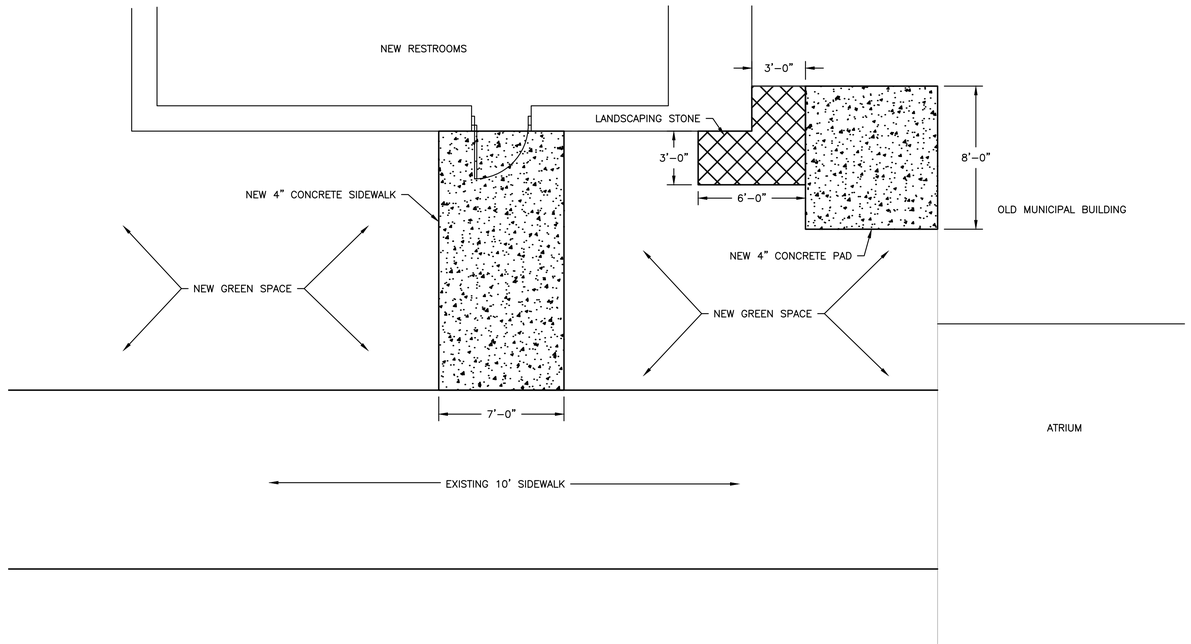
PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

TITLE SHEET

SHEET NO.:
T0.01



SITE LAYOUT PLAN

NOT TO SCALE

SEE DETAILS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION

FARMERS MARKET RESTROOM RENOVATION

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REVISIONS:

DATE: 05-17-2016

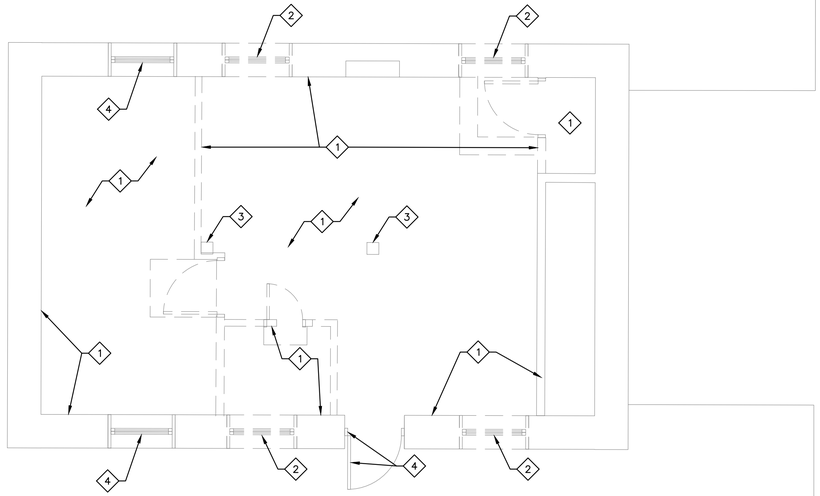
PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

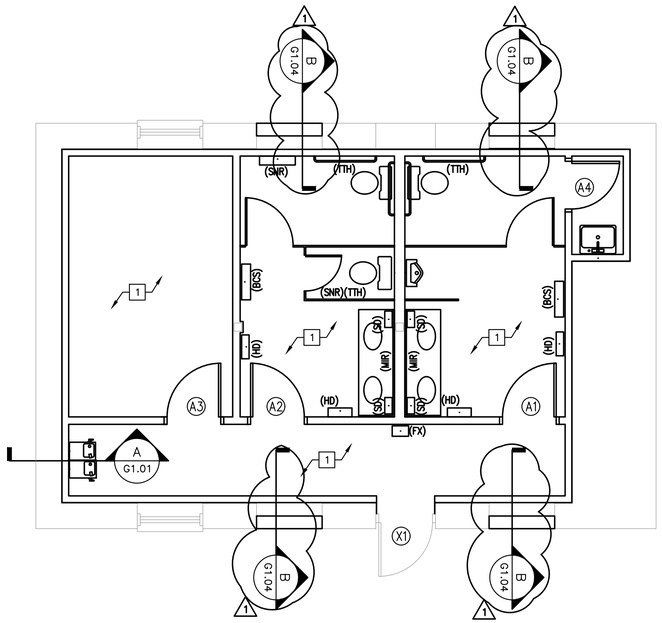
SCALE: N.T.S.

SITE LAYOUT PLAN

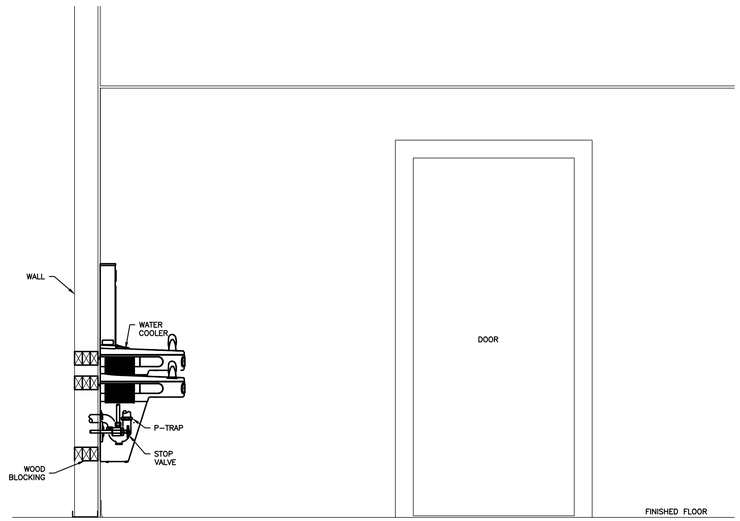
SHEET NO.:
C1.01



GENERAL DEMOLITION PLAN
NOT TO SCALE



GENERAL NEW CONSTRUCTION PLAN
NOT TO SCALE
SEE SHEET G2.01 FOR DIMENSIONAL DETAILS



A G1.01 SECTION VIEW A
NOT TO SCALE

DEMOLITION NOTES

1. REMOVE EXISTING STUD WALLS, DOORS, FRAMES, FINISHES, MILLWORK, PLUMBING FIXTURES, CEILINGS, LIGHTING FIXTURES, AND ELECTRICAL DEVICES.
2. REMOVE EXISTING WINDOW AND FRAME.
3. REMOVE AND REPLACE EXISTING COLUMNS; SEE SHEET S1.01.
4. EXISTING DOOR AND/OR WINDOW TO REMAIN.

CONSTRUCTION NOTES

1. SEE DIVISION 9 ON SHEET G1.02 FOR WALL AND CEILING FINISH REQUIREMENTS.

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SCALE: N.T.S.

GENERAL CONSTRUCTION PLAN

SHEET NO.:
G1.01

SPECIFICATIONS

DIVISION 1:
A. CONTRACTOR SHALL COMPLY WITH ALL STATE AND LOCAL BUILDING CODES.
B. PROVIDE SUBMITTALS ON ALL PRODUCTS UNLESS DETERMINED UNNECESSARY BY THE ARCHITECT.
C. ALL REQUIREMENTS SET FORTH IN AIA DOCUMENT A201 "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION" SHALL BE BINDING THROUGH THE EXTENT OF THIS PROJECT.
D. CONTRACTOR SHALL PROVIDE A CONSTRUCTION SCHEDULE PRIOR TO CONSTRUCTION AND SHALL MONITOR OR VERIFY STATUS WITH OWNER AND ARCHITECT WEEKLY.
E. PROVIDE FENCING, BARRIERS, AND SECURITY AS NEEDED.
F. MAINTAIN AS-BUILT DRAWINGS FOR RECORD.
G. ALL WORK IS TO BE PERFORMED DURING WORK HOURS APPROVED BY THE OWNER, THE GENERAL CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF ALL CONSTRUCTION ACTIVITIES WITH THE OWNER BEFORE PROCEEDING.

DIVISION 2:
A. PROVIDE SOIL TREATMENT FOR TERMITE CONTROL; EMULSIFIED TYPE FOR DILUTION WITH WATER; 5 YEAR WARRANTY AND COMPLIANT WITH ALL U.S. ENVIRONMENTAL PROTECTION AGENCY LAWS.
B. WHEREVER DEMOLITION AND REMODELING WORK OCCURS NEAR TO OTHER FINISHED MATERIAL, THE TRADE SHALL BE REQUIRED TO REPAIR ANY DAMAGED MATERIAL AS A RESULT OF THAT DEMOLITION OR REMODELING WORK.

DIVISION 5:
A. ALL STRUCTURAL STEEL TO BE ASTM A36 STEEL.
B. STEEL CONSTRUCTION TO BE IN ACCORDANCE WITH THE AISC MANUAL OF STEEL CONSTRUCTION.
C. COLD-FORMED METAL FRAMING SHALL BE ASTM A570/A570M GRADE 40 GALVANIZED SHEET STEEL CHANNEL SHAPE SOLID OR PUNCHED WEBS. SIZES AND GAUGES AS INDICATED. INSTALLTION TO CONFORM TO AISI – COLD-FORMED-STEEL DESIGN MANUAL. STEEL STUD FRAMING TO BE 20 GAUGE CHANNEL SHAPES. WALL FURRING MAY BE Z-SHAPES OR HAT CHANNELS.
D. ALL STEEL PRODUCTS INCLUDING, BUT NOT LIMITED TO ANGLES, PLATES, ANCHOR BOLTS, HANGERS, WASHERS, NUTS, AND OTHER FASTENERS IN DIRECT CONTACT WITH PRESSURE TREATED LUMBER SHALL BE STAINLESS STEEL.

DIVISION 6:
A. ALL WOOD IN CONTACT WITH SLABS ON GRADE OR MASONRY TO BE PRESSURE TREATED.
B. ALL LUMBER TO BE DRIED TO 19% MOISTURE CONTENT, S4S, STAMPED PER GRADING.
C. STRUCTURAL WOOD TO BE AS FOLLOWS:
STUDS – NO. 2 STUD
JOISTS – 1200 Fb
BEAMS – 1500 Fb
D. INTERIOR WOOD WINDOW CASING TO BE 1 $\frac{1}{16}$" X 3 $\frac{1}{2}$", WM-97 OR EQUAL WOOD BASE TO BE $\frac{11}{16}$" X 5 $\frac{1}{4}$", WM-163 OR EQUAL WOOD SHOE MOLDING T OBE $\frac{7}{16}$" X $\frac{3}{4}$", WM-127 OR EQUAL.
E. ALL CASEWORK TO BE AWI CUSTOM GRADE AND CONSTRUCTED OF $\frac{3}{4}$" PLWOOD WITH PLASTIC LAMINATE FINISH, COLORS AS SELCTED. ALL COUNTERTOPS SHALL BE 1" THICK SOLID HIGH DENSELY POLYETHYLENE (HDPE) WITH BACKSPLASHES, BY COMTEC INDUSTRIES OR APPROVED EQUIVALENT.

DIVISION 7:
A. BUILDING INSULATION TO BE AS FOLLOWS:
EXTERIOR STUD WALLS R-13 GLASS FIBER W/ FACING.
INTERIOR STUD WALLS R-11 GLASS FIBER UNFACED.
ABOVE CEILING R-19 GLASS FIBER W/ FACING.
B. INTERIOR JOINT SEALANTS TO BE ACRYLIC ASTM C834, PAINTABLE, EQUAL TO PECORA AC – 20.

DIVISION 8:
A. INTERIOR STEEL DOORS TO BE STEEL CRAFT "L" SERIES 18 GAUGE GALVANIZED & PRIMED INSULATED STEEL W/ 16 GAUGE GALVANIZED & PRIMED STEEL FRAME (OR EQUIVALENT). PROVIDE ADA LEVERS, SURFACE MOUNTED CLOSERS, AND OTHER HARDWARE PER SCHEDULE.
B. HARDWARE TO BE HEAVY DUTY COMMERCIAL GRADE 1 IN STAINLESS STEEL SATIN FINISH.

DIVISION 9:
A. GYPSUM BOARD TO BE $\frac{1}{2}$" AT WALLS (TO BE COVERED WITH FRP) AND $\frac{5}{8}$" AT CEILING. EXPOSED GYPSUM BOARD TO BE FINISHED TO LEVEL 4 STANDARD.
B. EPOXY RESIN FLOORING SHALL BE $\frac{3}{16}$" THICK MINIMUM HEAVY DUTY SKID-RESISTANT TROWELLED BLEND OF COLORED QUARTZ AGGREGATE IN A CLEAR EPOXY BINDER SYSTEM TO ALSO HAVE SEAMLESS INTEGRAL 6 HIGH COVE BASE; COMPRESSIVE STRENGTH TO BE 41,000 PSI (ASTM C-579); FLEXURAL STRENGTH TO BE 4,200 PSI (ASTM C0580).
C. F.R.P. WALL PANELS SHALL BE .09" THICK TEXTURED F.R.P. WITH PEBBLE FINISH AND WHITE COLOR, INSTALL WITH WHITE PLASTIC FASTENERS IN ACCORDANCE WITH MANUFACTURER.
D. PAINTED C.M.U. TO RECEIVE 1 COAT OF BLOCK FILLER, 2 COATS LATEX SEMI-GLOSS, AND 1 COAT CLEAR EPOXY GLAZE.
E. PAINTED GYPSUM BOARD TO RECEIVE 1 COAT PRIMER, AND 2 COATS LATEX OF SCHEDULED FINISH.
F. PAINTED WOOD SURFACES TO RECEIVE 1 COAT PRIMER, AND 2 COATS SEMI-GLOSS LATEX.
G. UNPRIMED STEEL SURFACES SHALL RECEIVE 1 COAT ALKYD PRIMER & 2 COATS ALKYD SEMI-GLOSS ENAMEL.

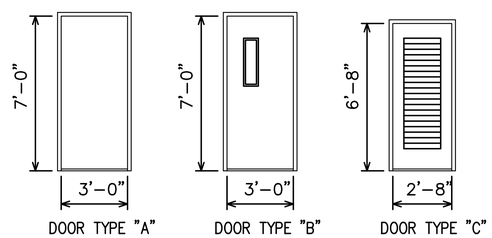
DIVISION 10:
A. TOILET PARTITIONS TO BE 1" THICK HIGH DENSITY POLYETHYLENE (HDPE) OVERHEAD-BRACED, "SCRANTON PRODUCTS"OR APPROVED EQUIVALENT. COLOR AS SELECTED BY OWNER.
B. TOILET ACCESSORIES TO BE "BOBRICK" (SUBSTITUTIONS ARE TO BE APPROVED BY THE OWNER). INSTALL PER ADA REGULATIONS AND MANUFACTURER'S SPECIFICATIONS VERIFY WITH OWNER THE LOCATION OF ALL TOILET ACCESSORIES.
TOILET ACCESSORY SCHEDULE:
1. (CH) – B-212 CLOTHES HOOK AND BUMB=PER
2. (GB) – B-6806 X 42", B-68606 X 36 SATIN FINISH GRAB BARS CONCEALED MTG.
3. (MIR) – B-165 5430 MIRROR IN STAINLESS STEEL CHANNEL FRAME
4. (HD) – B-7120 HAND DRYERS
5. (SD) – B-2112 STAINLESS STEEL SOAP DISPENSER
6. (TH) – B-7671 STAINLESS STEEL TOWEL HOOK
7. (TTH) – B-76867 BRUSHED FINISH S.S. DOUBLE ROLL TOILET TISSUE DISPENSER
8. (BCS) – BABY CHANGE STATION (ONE PER TOILET)
9. (LC) – "TRUEBRO MODEL 'LAV SHIELD' NO. 2018-AS-L LAVATORY PIPING COVER.
10. (SNR) – B-270 SANITARY NAPKIN RECEPTACLE
C. FIRE EXTINGUISHER – "LARSON MFG. CO." DRY CHEMICAL TYPE; CONFORMING TO NFPA 10; 10 LB CAPACITY CABINET: CAMEO SERIES, SEMI-RECESSED MOUNTING; CLEAR ACRYLIC BUBBLE IN ALUMINUM DOOR AND TRIM.
D. DOOR SIGNAGE – PROVIDE ALLOWANCE OF (1) SIGN PER SCHEDULED DOOR SIGNS SHALL BE FORMED MATTE PLASTIC WITH ADA COMPLIANT LETTERS AND RAISED BRAILLE SURFACE. COLORS AS SELECTED.
E. LAYOUT OF FURNITURE IS SHOWN FOR REFERENCE ONLY AND WILL BE PROVIDED BY THE OWNER UNLESS OTHERWISE NOTED.

SCHEDULE:

WATER CLOSET	– AMER. STD. 2998.012
TOILET SEAT	– CHURCH 295SSC
LAVATORY	– AMER. STD. 0355.012
LAV. FITTING	– MOEN 8810
PIPE INSUL.	– TRUBRO 105W
GRAB BAR	– BOBRICK 6806 x 42"
GRAB BAR	– BOBRICK 6806 x 36"
GRAB BAR	– BOBRICK 6806 x 18"
TOILET TISSUE	– BOBRICK 76867 DBL. ROLL
MIRROR	– BOBRICK 5430
SOAP	– BOBRICK 2112
HAND DRYERS	– BOBRICK B-7120
CAULK	– WHITE SILICONIZED LATEX

DOOR SCHEDULE

MARK	DOOR TYPE	SIZE	TYPE	GAUGE	CORE/LABEL	FRAME	GLASS	REMARKS
A1	GALVANIZED HOLLOW METAL	3'-0" X 7'-0" X 1 3/4"	A	18 GAUGE	INSUL.	16 GA. BY 5 3/4" DRYWALL	NONE	ADA PASSAGE LEVER, CLOSER, MUTES, BUMP
A2	GALVANIZED HOLLOW METAL	3'-0" X 7'-0" X 1 3/4"	A	18 GAUGE	INSUL.	16 GA. BY 5 3/4" DRYWALL	NONE	ADA PASSAGE LEVER, CLOSER, MUTES, BUMP
A3	GALVANIZED HOLLOW METAL	3'-0" X 7'-0" X 1 3/4"	B	18 GAUGE	INSUL.	16 GA. BY 5 3/4" DRYWALL	NONE	ADA LOCKSET LEVER, MUTES, BUMP
A4	GALVANIZED HOLLOW METAL	2'-8" X 6'-8" X 1 3/4"	C	18 GAUGE	LOUVER	16 GA. BY 5 3/4" DRYWALL	NONE	ADA LOCKSET LEVER, MUTES, BUMP, FGL (FULL GLAZED LOUVER)
X1	EXISTING TO REMAIN	3'-0" X 7'-0" X 1 3/4"	–	–	–	–	–	–



FARMERS MARKET RESTROOM RENOVATION

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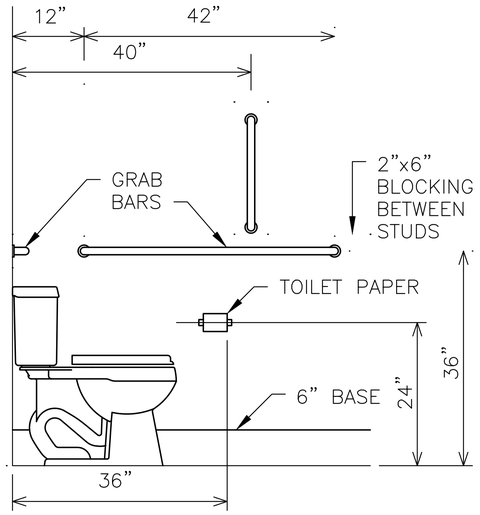
CONSTRUCTION DOCUMENTS

REVISIONS:

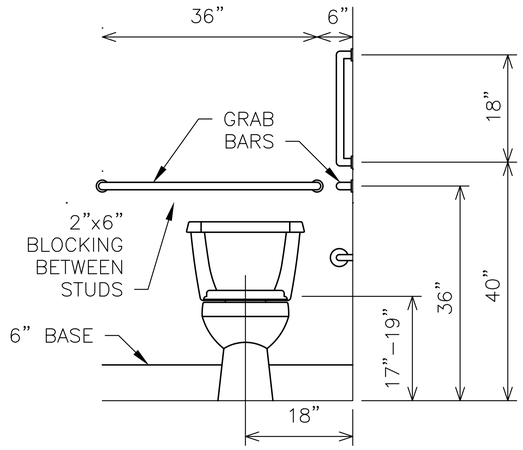
DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: XX

DETAILS

SHEET NO.:
G1.02

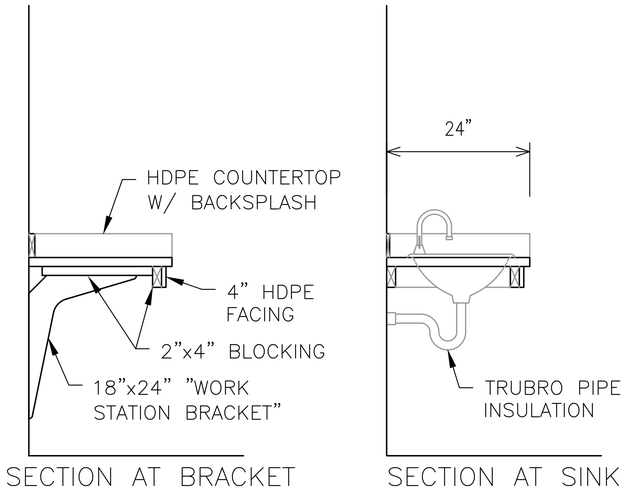


WATER CLOSET SIDE VIEW

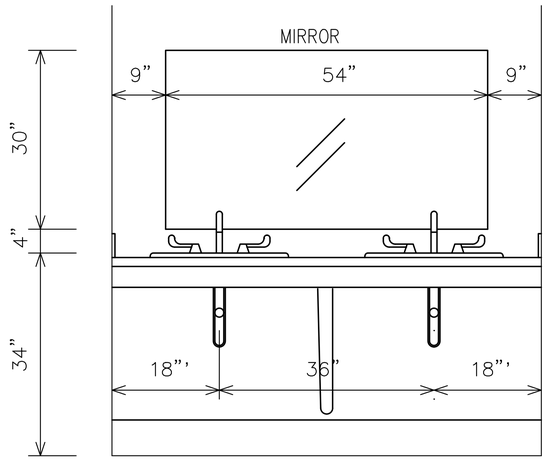


WATER CLOSET FRONT VIEW

TYPICAL TOILET FOR THE DISABLED
SCALE: 1/2"=1'-0"

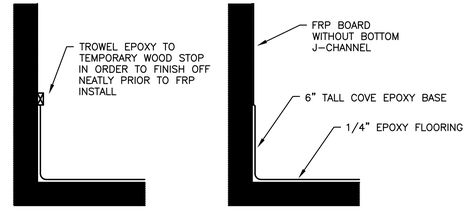


LAVATORY SIDE VIEWS



LAVATORY FRONT VIEW

TYPICAL VANITY COUNTERTOP
SCALE: 1/2"=1'-0"



COVE BASE DETAIL
NOT TO SCALE

FARMERS MARKET RESTROOM RENOVATION

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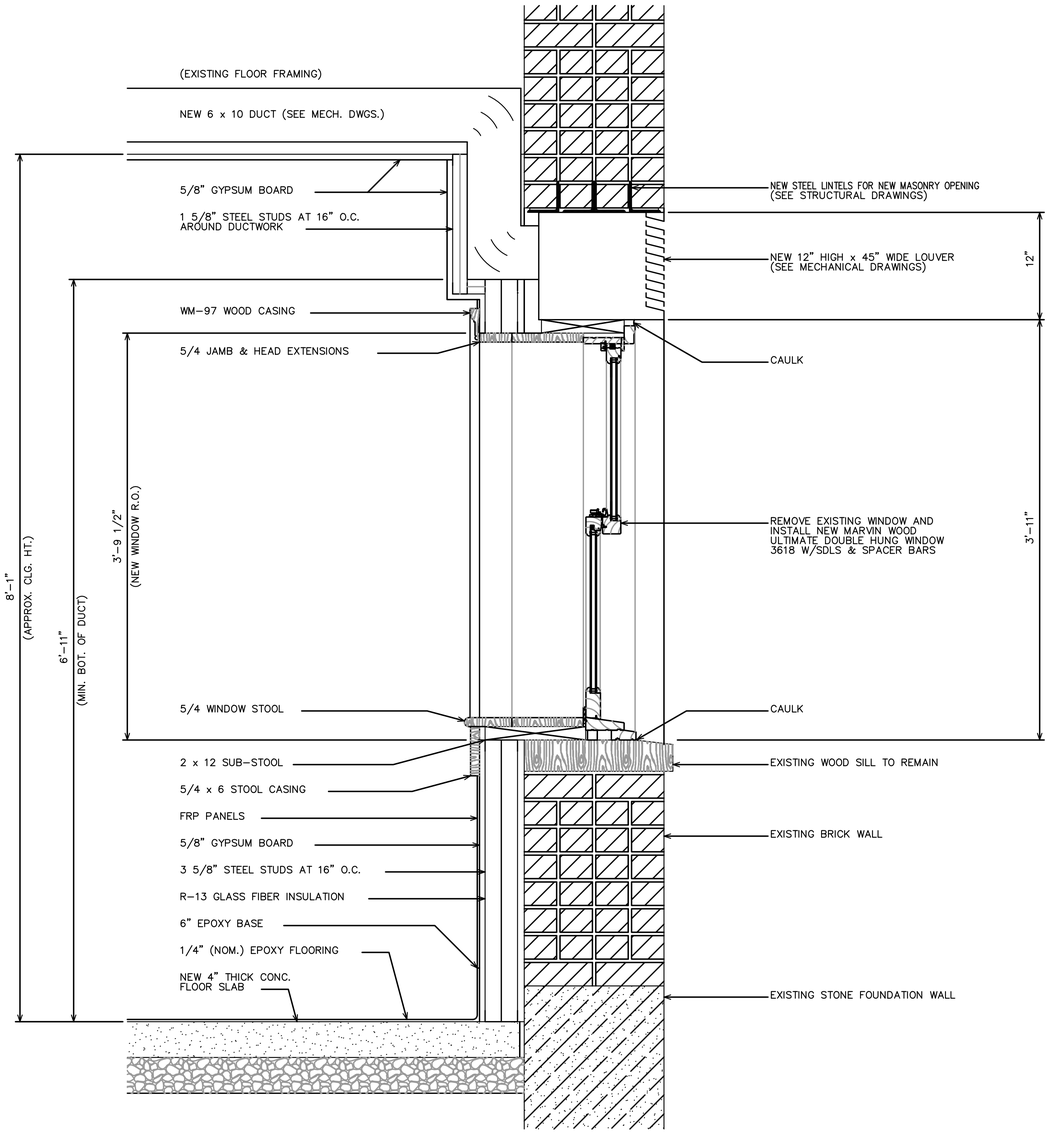
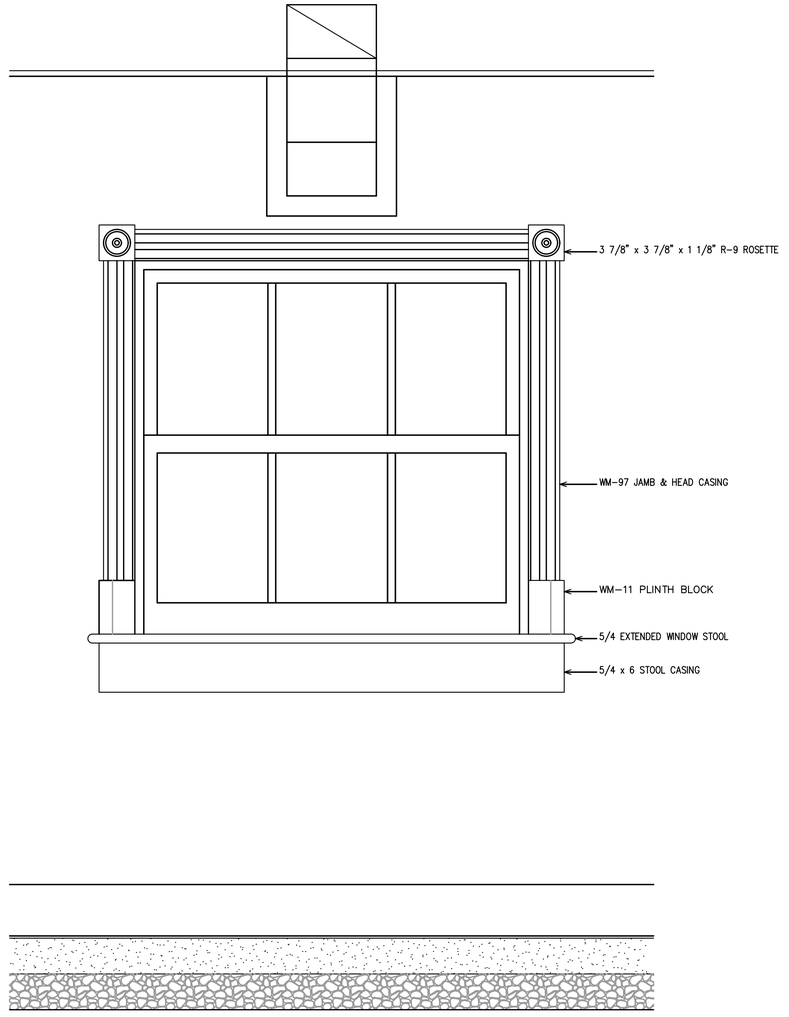
SCALE: XX

DETAILS

SHEET NO.:
G1.03



B G1.04 **BID ALTERNATE # 1**
1 1/2" = 1'-0"



INTERIOR ELEVATION – BID ALTERNATE # 1
1 1/2" = 1'-0"

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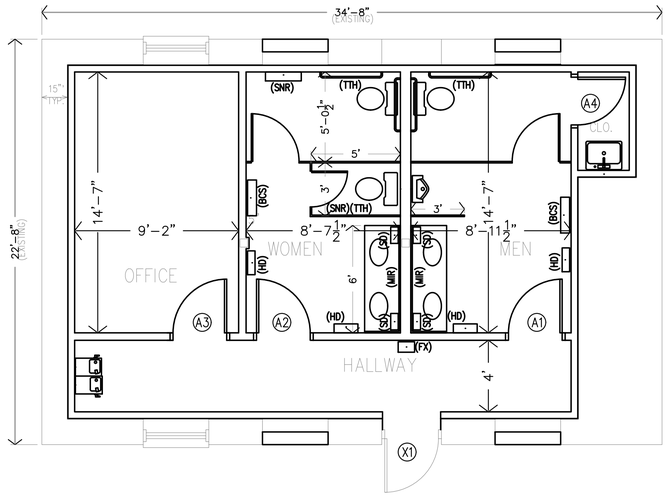
EXP./CLIENT NO: N/A
SCALE: XX

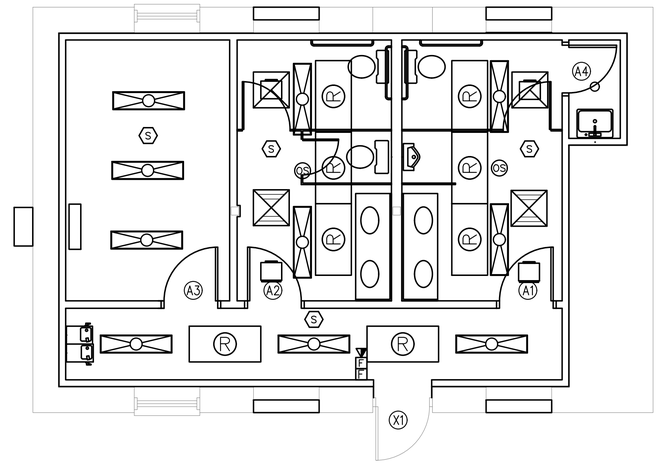
DETAILS

1 SHEET NO.: NEW SHEET
G1.04



DIMENSIONAL FLOOR PLAN

NOT TO SCALE



CEILING COORDINATION PLAN

NOT TO SCALE

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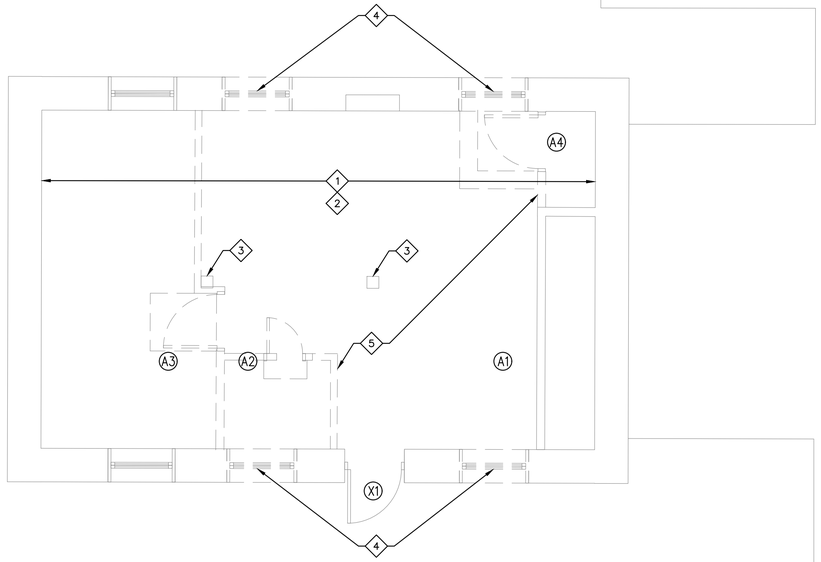
EXP./CLIENT NO: N/A

SCALE: N.T.S.

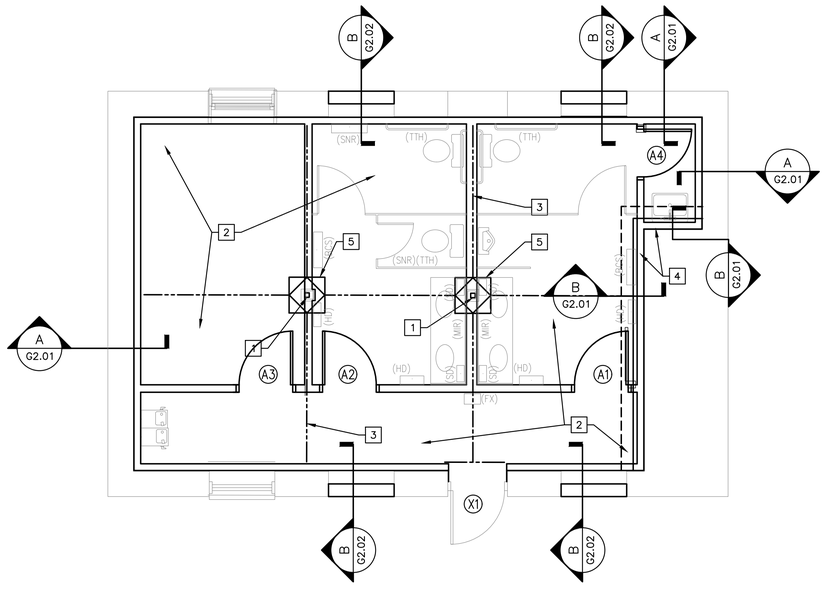
DIMENSIONAL FLOOR PLAN AND CEILING COORDINATION PLAN

SHEET NO.:

G2.01



STRUCTURAL DEMOLITION PLAN
SCALE: 1/4" = 1'-0"



STRUCTURAL PLAN
SCALE: 1/4" = 1'-0"

◇ DEMOLITION NOTES

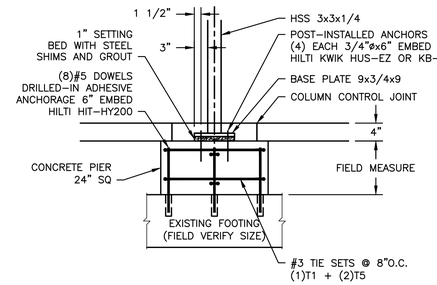
1. DEMOLISH AND REMOVE EXISTING FRAMED FLOOR SYSTEM.
2. DEMOLISH AND REMOVE EXISTING SLAB ABOVE PLUMBING TRENCHES. OTHERWISE SLAB MAY REMAIN. SOUND AND CHAIN DRAG SLAB TO DETERMINE POSSIBLE VOIDS UNDERNEATH. IF VOIDS ARE FOUND, FRACTURE SLAB LOCATED ABOVE VOIDS INTO SECTIONS OF 1 SF OR LESS TO ELIMINATE VOIDS. REFER TO PLUMBING DRAWINGS FOR LOCATIONS OF TRENCH AREAS.
3. EXISTING COLUMNS TO BE REMOVED. SHORE EXISTING STRUCTURE ABOVE UNTIL NEW COLUMNS ARE ERECTED.
4. DEMOLISH WINDOW AND ASSOCIATED FRAMING BACK TO ORIGINAL BRICK. THEN FIELD VERIFY DIMENSIONS OF MASONRY OPENING.
5. REFER TO ARCHITECTURAL DEMOLITION DRAWING FOR REMOVAL OF EXISTING PARTITIONS.

□ CONSTRUCTION NOTES

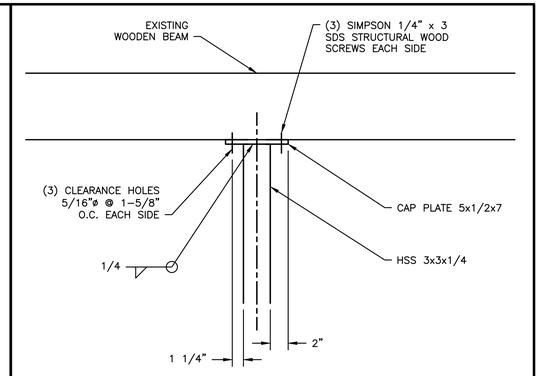
1. NEW STEEL COLUMNS HSS 3x3x1/4 WITH CAP PLATES AND BASE PLATES. SEE CAP AND BASE DETAILS.
2. NEW 4" CONCRETE SLAB WITH VAPOR RETARDER OVER COMPACTED AGGREGATE FILL AND BASE.
3. SAW-CUT (EARLY ENTRY/SOFF-CUT) CONTROL JOINTS ON ALL COLUMN LINES, BOTH DIRECTIONS, WITH FORMED DIAMOND COLUMN CONTROL JOINTS.
4. NEW SLAB SYSTEM TERMINATES AT EXISTING WALLS TO REMAIN WITH CMU EDGE COURSE BEARING ON EXISTING SLAB STRIP.
5. NEW 24x24 CONCRETE PIER ON EXISTING FOUNDATION. SEE BASE DETAIL.

GENERAL NOTES

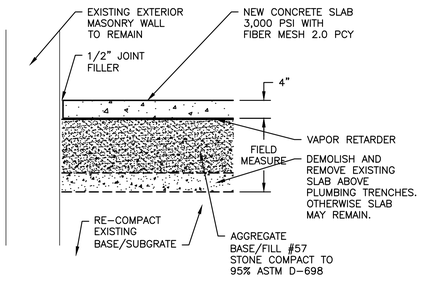
1. CONCRETE REINFORCING: ASTM A615, GRADE 60.
   HOLLOW CMU: ASTM C90
   MORTOR: ASTM C270, TYPE S.
   GROUT ASTM C476, 3,000 PSI.
   STEEL TUBING: ASTM A500, GRADE B.
   MISC. STEEL: ASTM A36.



COLUMN BASE PLATE DETAIL
NOT TO SCALE

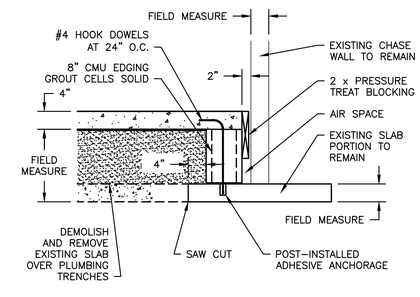


COLUMN CAP PLATE DETAIL
NOT TO SCALE



AT EXISTING EXTERIOR WALL

A G2.01 SECTION VIEW A
SCALE: 3/4" = 1'-0"



B G2.01 SECTION VIEW B
SCALE: 3/4" = 1'-0"

FARMERS MARKET RESTROOM RENOVATION
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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

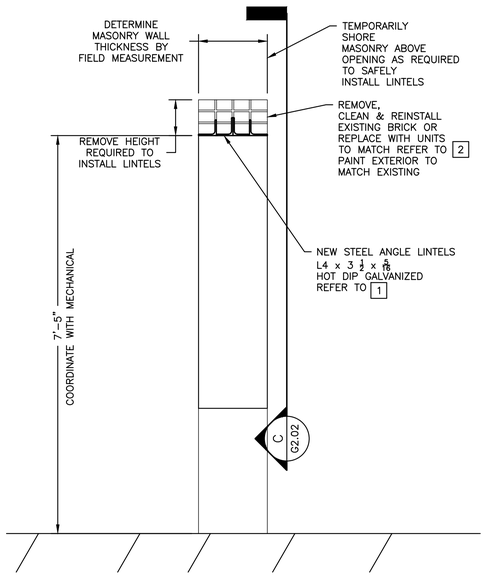
PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: 1/4" = 1'-0"

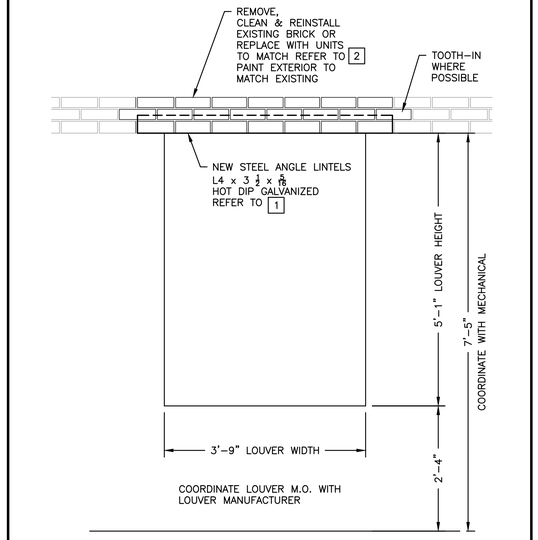
GENERAL STRUCTURAL PLANS, SECTIONS, AND DETAILS

SHEET NO.:
S1.01



AT EXISTING EXTERIOR WALL

B G2.02 **SECTION VIEW C**
SCALE: 3/4" = 1'-0"



c G2.02 **SECTION VIEW C**
SCALE: 3/4" = 1'-0"

◇ DEMOLITION NOTES

1. REMOVE AND REPLACE BRICK NECESSARY TO MAKE A NEW SQUARE AND STRUCTURALLY SOUND OPENING.

☐ CONSTRUCTION NOTES

1. PROVIDE LINTEL LENGTH REQUIRED TO ACHIEVE NOT LESS THAN 6" MASONRY BEARING LENGTH ON EACH SIDE. ORIENT 4" OR 3 1/2" LEGS HORIZONTAL TO PROVIDE BEST FIT AND SUPPORT FOR BRICK WYTHES.
2. COORDINATE WITH CITY FOR POTENTIAL HAZARDOUS MATERIAL ABATEMENT. MATCH EXISTING MORTAR COMPOSITION. ENSURE FACE BRICK IS LAID IN EXTERIOR WYTHE.

GENERAL NOTES

1. CONCRETE REINFORCING: ASTM A615, GRADE 60.
   HOLLOW CMU: ASTM C90.
   MORTAR: ASTM C270, TYPE S.
   GROUT: ASTM C476, 3,000 PSI.
   STEEL TUBING: ASTM A500, GRADE B.
   MISC. STEEL: ASTM A36.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: 1/4" = 1'-0"

GENERAL STRUCTURAL PLANS, SECTIONS, AND DETAILS

SHEET NO.:
S1.02

MECHANICAL LEGEND

ALL SYMBOLS INDICATED MAY NOT APPEAR ON THESE CONTRACT DRAWINGS

GENERAL

- EXISTING
- EXISTING TO BE REMOVED
- ITEM TO BE PROVIDED
- "DEMOLITION TO THIS POINT" SYMBOL
- "NEW CONSTRUCTION AT THIS POINT" SYMBOL

DUCTWORK AND ACCESSORIES

- E 75 — REGISTER/GRILLE/DIFFUSER (MARK/CFM)
- E 75 — EXISTING REGISTER/GRILLE/DIFFUSER (CFM AS SHOWN)
- E 75 — EXISTING RELOCATED/REINSTALLED REGISTER/GRILLE/DIFFUSER (CFM AS SHOWN)
- SUPPLY DIFFUSER 4-WAY
- SUPPLY DIFFUSER 3-WAY
- SUPPLY DIFFUSER 2-WAY
- SUPPLY DIFFUSER 2-WAY CORNER
- SUPPLY DIFFUSER 1-WAY
- SUPPLY GRILLE OR REGISTER
- RETURN GRILLE
- EXHAUST GRILLE
- F — HORIZONTAL FIRE DAMPER
- F — VERTICAL FIRE DAMPER
- F/SD — HORIZONTAL FIRE AND SMOKE DAMPER
- F/SD — VERTICAL FIRE AND SMOKE DAMPER
- SD — HORIZONTAL SMOKE DAMPER
- SD — VERTICAL SMOKE DAMPER
- VOLUME DAMPER
- R — VOLUME DAMPER W/REMOTE DAMPER OPERATOR
- M — MOTOR OPERATED DAMPER
- OUTSIDE AIR DUCT (NEGATIVE PRESSURE)
- SUPPLY DUCT SECTION (POSITIVE PRESSURE)
- RETURN DUCT SECTION (NEGATIVE PRESSURE)
- EXHAUST DUCT SECTION (NEGATIVE PRESSURE)
- FLEXIBLE DUCT
- 22 x 14 — DUCT SIZE (INCHES), FIRST FIGURE IS SIDE SHOWN
- 12ø — ROUND DUCT SIZE (INCHES)
- 24 x 12ø — OVAL DUCT SIZE (INCHES), FIRST FIGURE IS SIDE SHOWN
- DN — CHANGE OF ELEVATION-RISE (UP)-DROP (DN)
- AFS — AIR FLOW STATION
- VAV BOX WITH HOT WATER COIL
- RADIANT CEILING PANEL
- AD — ACCESS DOOR, VERTICAL OR HORIZONTAL
- UC — 3/4" DOOR UNDERCUT
- DG — DOOR GRILLE

CONTROLS

- T — ELECTRIC THERMOSTAT (MOUNT 48" AFF U.O.N)
- T — PNEUMATIC THERMOSTAT (MOUNT 48" AFF U.O.N)
- SD — SMOKE DETECTOR
- PS — PRESSURE SWITCH
- FS — FLOW SWITCH

PIPING

- DOMESTIC COLD WATER
- A — COMPRESSED AIR
- BBD — BOILER BLOW DOWN
- CD — CONDENSATE DRAIN
- CR — CONDENSER WATER RETURN

PIPING (CONT.)

- CS — CONDENSER WATER SUPPLY
- CWR — CHILLED WATER RETURN
- CWS — CHILLED WATER SUPPLY
- FOR — FUEL OIL RETURN
- FOS — FUEL OIL SUCTION
- FOV — FUEL OIL TANK VENT
- G — NATURAL GAS
- HPC — HIGH PRESSURE CONDENSATE
- HPS — HIGH PRESSURE STEAM
- HWR — HEATING WATER RETURN
- HWS — HEATING WATER SUPPLY
- LPC — LOW PRESSURE CONDENSATE
- LPG — LIQUEFIED PETROLEUM GAS (PROPANE)
- LPS — LOW PRESSURE STEAM
- MPC — MEDIUM PRESSURE CONDENSATE
- MPS — MEDIUM PRESSURE STEAM
- PC — PUMPED CONDENSATE
- RL — REFRIGERANT LIQUID
- RS — REFRIGERANT SUCTION
- STM — STEAM
- SW — SOFT WATER

PIPE FITTINGS

- PIPE CAP
- PIPE TURNING UP
- PIPE TURNING DOWN
- TEE AND ELBOW UP
- TEE AND ELBOW DOWN
- TEE UP
- TEE DOWN
- UNION
- CONCENTRIC PIPE REDUCER/INCREASER
- ECCENTRIC PIPE REDUCER/INCREASER

VALVES AND PIPING SPECIALTIES

- ANGLE GATE VALVE
- ANGLE GLOBE VALVE
- PRESSURE RELIEF/SAFETY VALVE
- AUTOFLOW CONTROL VALVE
- CIRCUIT SETTER
- BALL VALVE
- BUTTERFLY VALVE
- GATE VALVE
- GLOBE VALVE
- NEEDLE VALVE
- PRESSURE REDUCING VALVE
- THREE WAY CONTROL VALVE
- THREE WAY VALVE
- TWO WAY CONTROL VALVE
- S — SOLENOID VALVE
- FLOW METER
- TRIPLE DUTY VALVE
- GAS COCK
- SWING GATE CHECK VALVE
- SPRING CHECK VALVE
- FLOW ORIFICE
- STRAINER
- STRAINER WITH BLOWDOWN
- PRESSURE GAUGE WITH GAUGE COCK
- THERMOMETER
- AAV — AUTOMATIC AIR VENT
- MAV — MANUAL AIR VENT

MECHANICAL ABBREVIATIONS

ALL ABBREVIATIONS INDICATED MAY NOT APPEAR ON THESE CONTRACT DRAWINGS

AMP	AMPERE
A/C	AIR CONDITIONING
ABV	ABOVE
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR (18" UON)
AFG	ABOVE FINISHED GRADE (18" UON)
AHU	AIR HANDLING UNIT
ALT	ALTERNATE
AMB	AMBIENT
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
AVG	AVERAGE
BEL	BELOW
BHP	BRAKE HORSEPOWER
BLDG	BUILDING
BTUH	BRITISH THERMAL UNIT PER HOUR
CC	COOLING COIL
CLG	CEILING
dB	DECIBELS
Db	DRY BULB TEMPERATURE
DEMO	DEMOLITION
DIA	DIAMETER
DN	DOWN
DWG	DRAWING
DX	DIRECT EXPANSION
EA	EXHAUST AIR
EC	ELECTRICAL CONTRACTOR
EDH	ELECTRIC DUCT HEATER
EER	ENERGY EFFICIENCY RATIO
EF	EXHAUST FAN
EQUIP	EQUIPMENT
ER	EXISTING RELOCATED
ET	EXPANSION TANK
ETR	EXISTING TO REMAIN
EUH	ELECTRIC UNIT HEATER
EWH	ELECTRIC WATER HEATER
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING
FBO	FURNISHED BY OTHERS
FCU	FAN COIL UNIT
FD	FLOOR DRAIN
FLEX	FLEXIBLE
FLR	FLOOR
FOB	FLAT ON BOTTOM
FOT	FLAT ON TOP
FTR	FIN TUBE RADIATION
GC	GENERAL CONTRACTOR
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HC	HEATING COIL
HORZ	HORIZONTAL
HP	HORSEPOWER
HPC	HIGH PRESSURE STEAM CONDENSATE RETURN
HPS	HIGH PRESSURE STEAM
HGT	HEIGHT
HV	HEATING AND VENTILATING UNIT
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
I.E.	INVERT ELEVATION
I.V.	INLET VANES
KW	KILOWATTS
LBS	POUNDS
LBS/HR	POUNDS PER HOUR
LPC	LOW PRESSURE STEAM CONDENSATE RETURN
LPS	LOW PRESSURE STEAM
LWT	LEAVING WATER TEMPERATURE
MAX.	MAXIMUM
MBH	1,000 BTUH
MC	MECHANICAL CONTRACTOR
MFR	MANUFACTURER
MIN.	MINIMUM
MOD	MOTOR OPERATED DAMPER
MPC	MEDIUM PRESSURE STEAM CONDENSATE RETURN
MPS	MEDIUM PRESSURE STEAM
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NOM.	NOMINAL
NTS	NOT TO SCALE
OA	OUTSIDE AIR
PC	PUMPED CONDENSATE
PD	PRESSURE DROP
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
P/T	PRESSURE/TEMPERATURE TAP
RA	RETURN AIR
RD	ROOF DRAIN
RF	RETURN FAN
RH	RELATIVE HUMIDITY
SA	SUPPLY AIR
S/S	STAINLESS STEEL
SF.	SQUARE FEET
SP	STATIC PRESSURE
SPEC	SPECIFICATION
STD	STANDARD
SW	SOFTENED WATER
TEMP	TEMPERATURE
TOF	TOP OF FOOTER
TYP	TYPICAL
UC	UNDERCOUNTER
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORY
U.O.N	UNLESS OTHERWISE NOTED
VD	VOLUME DAMPER (MANUAL OPPOSED BLADE)
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
W/	WITH
W/O	WITH OUT
Wb	WET BULB TEMPERATURE
WTR	WATER
WWM	WELDED WIRE MESH

MEP DESIGN SUMMARY

PROJECT INFORMATION

PROJECT NAME:	FARMERS MARKET RESTROOM RENOVATION
ADDRESS:	345 SOUTH MAIN STREET HARRISONBURG, VA. 22801
PROPOSED USE:	OFFICE AND PUBLIC RESTROOMS
OWNER:	CITY OF HARRISONBURG
OWNER CONTACT:	ADAM WRIGHT
PHONE:	540-560-9455
VE PROJ. NO.:	10895-3

APPLICABLE CODES

BUILDING CODE:	VIRGINIA REHABILITATION CODE: 2012 WORK COMPLIANCE METHOD
MECHANICAL CODE:	VIRGINIA MECHANICAL CODE: 2012
PLUMBING CODE:	VIRGINIA PLUMBING CODE: 2012
ELECTRICAL CODE:	NFPA 70, 2011 NATIONAL ELECTRICAL CODE
ACCESSIBILITY CODE:	ICC/ANSI A117.1 2009 STANDARDS ON ACCESSIBLE AND USABLE BUILDING AND FACILITIES
GAS CODE:	VIRGINIA FUEL GAS CODE: 2012

PROJECT TEAM

PROJECT MANAGER:	PHIL GENTRY
PROJECT TEAM:	JOHN SOLDANO – HVAC ENGINEER MATT SHOCKEY – PLUMBING ENGINEER KEVIN KLINE – ELECTRICAL ENGINEER TED ENOSAKI – STRUCTURAL ENGINEER TIM HOUSDEN – ELECTRICAL DESIGNER

DRAWING LIST

FARMERS MARKET RESTROOM RENOVATION

345 SOUTH MAIN STREET
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CONSTRUCTION DOCUMENTS

REVISIONS:
1 BID ALTERNATE # 1

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

MECHANICAL LEGEND, ABBREVIATIONS, AND NOTES

SHEET NO.:
M0.01

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1: GENERAL

1.1 SUMMARY

A. CONTRACTOR SHALL BE RESPONSIBLE FOR A COMPLETE SYSTEM INCLUDING HVAC BALANCING. ALL EQUIPMENT AND RELATED ITEMS INDICATED ON CONTRACT DRAWINGS SHALL BE BY MECHANICAL CONTRACTOR UNLESS NOTED BY OWNER OR BY OTHERS. DIFFERENCES AND/OR CONFLICTS BETWEEN CONTRACT DRAWINGS AND SPECIFICATIONS AND SHOP DRAWINGS, SHALL BE CALLED TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE. IF DIFFERENCES ARE NOT NOTED TO THE OWNER'S REPRESENTATIVE PRIOR TO CONTRACT, OWNER'S REPRESENTATIVE SHALL DETERMINE GOVERNING CONDITION AND SUBCONTRACTOR SHALL PERFORM ALL WORK AT NO ADDITIONAL COST. TRADE NAMES USED TO ESTABLISH QUALITY MAY BE APPROVED BY THE OWNER'S REPRESENTATIVE. HVAC EQUIPMENT CONTROLS TO BE PROVIDED BY CONTRACTOR. EQUIPMENT/MATERIAL SUBSTITUTIONS ARE ACCEPTABLE, PROVIDED REQUEST FOR SUBSTITUTIONS IS/ARE MADE IN WRITING FOR APPROVAL BY ARCHITECT/ENGINEER TO ALLOW A MINIMUM OF 2 WEEKS REVIEW OF SUBSTITUTION REQUEST.

1.3 QUALITY ASSURANCE

A. STEEL SUPPORT WELDING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO AWS D1.1, "STRUCTURAL WELDING CODE––STEEL."
B. STEEL PIPE WELDING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX, "WELDING AND BRAZING QUALIFICATIONS."
   1. COMPLY WITH PROVISIONS IN ASME B31 SERIES, "CODE FOR PRESSURE PIPING."
   2. CERTIFY THAT EACH WELDER HAS PASSED AWS QUALIFICATION TESTS FOR WELDING PROCESSES INVOLVED AND THAT CERTIFICATION IS CURRENT.
C. ELECTRICAL CHARACTERISTICS FOR MECHANICAL EQUIPMENT: EQUIPMENT OF HIGHER ELECTRICAL CHARACTERISTICS MAY BE FURNISHED PROVIDE SUCH PROPOSED EQUIPMENT IS APPROVED IN WRITING AND CONNECTING ELECTRICAL SERVICES, CIRCUIT BREAKERS, AND CONDUIT SIZES ARE APPROPRIATELY MODIFIED. IF MINIMUM ENERGY RATINGS OR EFFICIENCIES ARE SPECIFIED, EQUIPMENT SHALL COMPLY WITH REQUIREMENTS.

1.4 DELIVERY, STORAGE, AND HANDLING

A. DELIVER PIPES AND TUBES WITH FACTORY–APPLIED END CAPS. MAINTAIN END CAPS THROUGH SHIPPING, STORAGE, AND HANDLING TO PREVENT PIPE END DAMAGE AND TO PREVENT ENTRANCE OF DIRT, DEBRIS, AND MOISTURE.
B. STORE PLASTIC PIPES PROTECTED FROM DIRECT SUNLIGHT. SUPPORT TO PREVENT SAGGING AND BENDING.
C. MATERIALS FURNISHED BY THE MECHANICAL CONTRACTOR: EQUIPMENT AND MATERIALS WILL BE RECEIVED/CHECKED IN UNDAMAGED CONDITION, WITH PROPER ACCESSORIES, AND STORED AT THE SITE IN A CONVENIENT LOCATION FOR INSTALLATION. DAMAGED EQUIPMENT AND/OR MATERIALS, SHALL BE REPLACED BY SUPPLIER AT NO COST TO THE OWNER. UNLESS OTHERWISE SPECIFIED, ALL MECHANICAL EQUIPMENT INDICATED IN THE SPECIFICATIONS, DETAILS, SCHEDULES, AND/OR DRAWINGS SHALL BE FURNISHED BY MECHANICAL CONTRACTOR AND INSTALLED BY THE MECHANICAL CONTRACTOR.
D. CONTRACTORS EQUIPMENT STORAGE: EQUIPMENT STORED AT THE SITE SHALL BE ADEQUATELY PROTECTED FROM THE WEATHER AND DAMAGE. EQUIPMENT AND/OR MATERIALS DAMAGED IN STORAGE SHALL BE REPLACED BY CONTRACTOR AT NO COST TO OWNER.
E. TOUCH–UP AND COMPLETION: HVAC CONTRACTOR WILL BE RESPONSIBLE FOR PROTECTING AND KEEPING CLEAN HVAC EQUIPMENT DURING INSTALLATION. HVAC CONTRACTOR TO TEST EACH SYSTEM AND/OR PIECE OF EQUIPMENT INSTALLED AND REPORT TO OWNER'S REPRESENTATIVE ANY EQUIPMENT DAMAGE OR MALFUNCTION. CONTRACTOR SHALL TOUCH–UP PAINT ANY SURFACES THAT HAVE BEEN DAMAGED OR PAINT SCRAPED OFF DURING CONSTRUCTION.

1.5 COORDINATION

A. COORDINATE PIPE SPACES, CHASES, SLOTS, OPENINGS IN BUILDING STRUCTURE, INSTALLATION OF SUPPORTING DEVICES AND SLEEVES DURING PROGRESS OF CONSTRUCTION, TO ALLOW FOR MECHANICAL INSTALLATIONS.
B. COORDINATE REQUIREMENTS FOR ACCESS PANELS AND DOORS FOR MECHANICAL ITEMS REQUIRING ACCESS THAT ARE CONCEALED BEHIND FINISHED SURFACES.

1.6 TEMPORARY HEATING, POWER, COMPRESSED AIR, AND WATER

A. WILL BE ARRANGED BY THE CONTRACTOR AT THE SITE.

1.7 ELECTRICAL WIRING

A. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL POWER WIRING, INCLUDING CONDUIT, WIRE AND CONNECTIONS. ALL STARTERS, FUSES, AND DISCONNECTS BY ELECTRICAL CONTRACTOR EXCEPT WHERE SPECIFIED AS PART OF PACKAGED EQUIPMENT. STARTERS THAT COME WITH EQUIPMENT SHALL BE AUTOMATIC AND HAVE THERMAL OVERLOADS (3 FOR 3 PHASE) AND HAVE APPROPRIATE COVERS AND INTERLOCKS. ALL MOTORS LESS THAN 3/4 HP ARE 115V/1 PH/60 HZ UNLESS OTHERWISE SPECIFIED, WITH INTEGRAL THERMAL OVERLOAD UNLESS OTHERWISE SPECIFIED. ELECTRICAL CONTRACTOR SHALL LABEL ALL REMOVABLE PANELS FOR DISCONNECTS IN EQUIPMENT CABINETS WITH NAMEPLATE FURNISHED BY CONTRACTOR (LABELED – "ELECTRICAL SERVICE DISCONNECT LOCATED BEHIND THIS PANEL"). ELECTRICAL DISCONNECTS AND/OR ELECTRICAL BOXES/PANELS SHALL NOT BE INSTALLED OVER NAMEPLATES OF EQUIPMENT.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. IN OTHER PART 2 ARTICLES WHERE SUBPARAGRAPH TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY FOR PRODUCT SELECTION:
   1. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE MANUFACTURERS SPECIFIED.

2.2 JOINING MATERIALS

A. REFER TO INDIVIDUAL DIVISION 23 PIPING SECTIONS FOR SPECIAL JOINING MATERIALS NOT LISTED BELOW.
B. PIPE–FLANGE GASKET MATERIALS: SUITABLE FOR CHEMICAL AND THERMAL CONDITIONS OF PIPING SYSTEM CONTENTS.
C. FLANGE BOLTS AND NUTS: ASME B18.2.1, CARBON STEEL, UNLESS OTHERWISE INDICATED.
D. SOLDER FILLER METALS: ASTM B 32, LEAD–FREE ALLOYS. INCLUDE WATER–FLUSHABLE FLUX ACCORDING TO ASTM B813.
E. BRAZING FILLER METALS: AWS A5.8, BCUP SERIES, COPPER–PHOSPHORUS ALLOYS FOR GENERAL–DUTY BRAZING, UNLESS OTHERWISE INDICATED; A AND AWS A5.8, BAG1, SILVER ALLOY FOR REFRIGERANT PIPING, UNLESS OTHERWISE INDICATED.
F. WELDING FILLER METALS: COMPLY WITH AWS D10.12 FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND CHEMICAL ANALYSIS OF STEEL PIPE BEING WELDED.
G. SOLVENT CEMENTS FOR JOINING PVC PIPING: ASTM D 2564. INCLUDE PRIMER ACCORDING TO ASTM F 656.

2.3 DIELECTRIC FITTINGS

A. DESCRIPTION: COMBINATION FITTING OF COPPER ALLOY AND FERROUS MATERIALS WITH THREADED, SOLDER–JOINT, PLAIN, OR WELD–NECK END CONNECTIONS THAT MATCH PIPING SYSTEM MATERIALS. DIELECTRIC UNIONS, FLANGES, FLANGE KITS, COUPLINGS, AND NIPPLES.
B. INSULATING MATERIAL: SUITABLE FOR SYSTEM FLUID, PRESSURE, AND TEMPERATURE.

2.4 MECHANICAL SLEEVE SEALS

A. DESCRIPTION: MODULAR SEALING ELEMENT UNIT, DESIGNED FOR FIELD ASSEMBLY, TO FILL ANNULAR SPACE BETWEEN PIPE AND SLEEVE. SEALING ELEMENTS SHALL BE EPDM INTERLOCKING LINKS SHAPED TO FIT SURFACE OF PIPE AND OF TYPE AND NUMBER REQUIRED FOR PIPE MATERIAL AND SIZE OF PIPE. PRESSURE PLATES SHALL BE COMPOSITE OR PLASTIC. INCLUDE TWO FOR EACH SEALING ELEMENT. CONNECTING BOLTS AND NUTS SHALL BE STAINLESS STEEL OF LENGTH REQUIRED TO SECURE PRESSURE PLATES TO SEALING ELEMENTS. INCLUDE ONE FOR EACH SEALING ELEMENT.
B. MANUFACTURERS:
   1. LINK–SEAL.
   2. ADVANCE PRODUCTS & SYSTEMS, INC.
   3. MASON–DALLAS.
   4. METRAFLEX CO.

2.5 SLEEVES

A. GALVANIZED–STEEL SHEET: 0.0239–INCH MINIMUM THICKNESS; ROUND TUBE CLOSED WITH WELDED LONGITUDINAL JOINT.
B. STEEL PIPE: ASTM A 53, TYPE E, GRADE B, SCHEDULE 40, GALVANIZED, PLAIN ENDS.
C. CAST IRON: CAST OR FABRICATED "WALL PIPE" EQUIVALENT TO DUCTILE–IRON PRESSURE PIPE, WITH PLAIN ENDS AND INTEGRAL WATERSTOP, UNLESS OTHERWISE INDICATED.

2.6 ESCUTCHEONS

A. DESCRIPTION: MANUFACTURED WALL AND CEILING ESCUTCHEONS AND FLOOR PLATES, WITH POLISHED CHROME–PLATED FINISH.

2.7 GROUT

A. DESCRIPTION: ASTM C 1107, GRADE B, NON–SHRINK AND NONMETALLIC, DRY HYDRAULIC–CEMENT GROUT. CHARACTERISTICS: POST–HARDENING, VOLUME–ADJUSTING, NON–STAINING, NON–CORROSIVE, NONGASEOUS, AND RECOMMENDED FOR INTERIOR AND EXTERIOR APPLICATIONS. DESIGN MIX SHALL BE 5000–PSI, 28–DAY COMPRESSIVE STRENGTH. PREMIXED AND FACTORY PACKAGED.

PART 3: EXECUTION

3.1 MECHANICAL DEMOLITION

A. DISCONNECT, DEMOLISH, AND REMOVE MECHANICAL SYSTEMS, EQUIPMENT, AND COMPONENTS INDICATED TO BE REMOVED. REMOVE PORTION OF PIPING OR DUCT INDICATED TO BE REMOVED AND CAP OR PLUG REMAINING PIPING OR DUCT WITH SAME OR COMPATIBLE MATERIAL. DISCONNECT AND CAP SERVICES AND REMOVE EQUIPMENT AS INDICATED. DELIVER TO OWNER WHERE INDICATED.
B. IF PIPE, INSULATION, OR EQUIPMENT TO REMAIN IS DAMAGED IN APPEARANCE OR IS UNSERVICEABLE, REMOVE DAMAGED OR UNSERVICEABLE PORTIONS AND REPLACE WITH NEW PRODUCTS OF EQUAL CAPACITY AND QUALITY.

3.2 PIPING SYSTEMS – COMMON REQUIREMENTS

A. INSTALL PIPING ACCORDING TO THE FOLLOWING REQUIREMENTS AND DIVISION 23 SECTIONS SPECIFYING PIPING SYSTEMS. SELECT SYSTEM COMPONENTS WITH PRESSURE RATING EQUAL TO OR GREATER THAN SYSTEM OPERATING PRESSURE.
B. DRAWING PLANS, SCHEMATICS, AND DIAGRAMS INDICATE GENERAL LOCATION AND ARRANGEMENT OF PIPING SYSTEMS. INDICATED LOCATIONS AND ARRANGEMENTS WERE USED TO SIZE PIPE AND CALCULATE FRICTION LOSS, EXPANSION, PUMP SIZING, AND OTHER DESIGN CONSIDERATIONS. INSTALL PIPING AS INDICATED UNLESS DEVIATIONS TO LAYOUT ARE APPROVED.
C. INSTALL PIPING IN CONCEALED LOCATIONS, UNLESS OTHERWISE INDICATED AND EXCEPT IN EQUIPMENT ROOMS AND SERVICE AREAS. INSTALL PIPING INDICATED TO BE EXPOSED AND PIPING IN EQUIPMENT ROOMS AND SERVICE AREAS AT RIGHT ANGLES OR PARALLEL TO BUILDING WALLS. DIAGONAL RUNS ARE PROHIBITED UNLESS SPECIFICALLY INDICATED OTHERWISE.
D. INSTALL PIPING ABOVE ACCESSIBLE CEILINGS TO ALLOW SUFFICIENT SPACE FOR CEILING PANEL REMOVAL.
E. INSTALL PIPING TO PERMIT VALVE SERVICING.
F. INSTALL PIPING AT INDICATED SLOPES AND FREE OF SAGS AND BENDS. INSTALL FITTINGS FOR CHANGES IN DIRECTION AND BRANCH CONNECTIONS.
G. INSTALL PIPING TO ALLOW APPLICATION OF INSULATION.
H. INSTALL ESCUTCHEONS FOR PENETRATIONS OF WALLS, CEILINGS, AND FLOORS ACCORDING TO THE FOLLOWING:
   1. NEW PIPING:
      a. PIPING WITH FITTING OR SLEEVE PROTRUDING FROM WALL: ONE–PIECE, DEEP–PATTERN TYPE.
      b. INSULATED PIPING IN FINISHED SPACES: SPLIT–CASTING, CAST–BRASS TYPE WITH POLISHED CHROME–PLATED FINISH.
      c. BARE PIPING AT WALL, FLOOR AND CEILING PENETRATIONS IN FINISHED SPACES: SPLIT–CASTING, CAST–BRASS TYPE WITH POLISHED CHROME–PLATED FINISH.
I. INSTALL SLEEVES FOR PIPES PASSING THROUGH CONCRETE AND MASONRY WALLS, GYPSUM–BOARD PARTITIONS, AND CONCRETE FLOOR AND ROOF SLABS. SLEEVES ARE NOT REQUIRED FOR CORE–DRILLED HOLES.
   1. CUT SLEEVES TO LENGTH FOR MOUNTING FLUSH WITH BOTH SURFACES EXCEPT EXTEND SLEEVES INSTALLED IN FLOORS OF MECHANICAL EQUIPMENT AREAS OR OTHER WET AREAS 2 INCHES ABOVE FINISHED FLOOR LEVEL. EXTEND CAST–IRON SLEEVE FITTINGS BELOW FLOOR SLAB AS REQUIRED TO SECURE CLAMPING RING IF RING IS SPECIFIED.
   2. INSTALL SLEEVES IN NEW WALLS AND SLABS AS NEW WALLS AND SLABS ARE CONSTRUCTED.
   3. INSTALL SLEEVES THAT ARE LARGE ENOUGH TO PROVIDE 1/4–INCH ANNULAR CLEAR SPACE BETWEEN SLEEVE AND PIPE OR PIPE INSULATION. USE THE FOLLOWING SLEEVE MATERIALS:
      a. STEEL PIPE SLEEVES: FOR PIPES SMALLER THAN NPS 4.
      b. STEEL SHEET SLEEVES: FOR PIPES NPS 4 AND LARGER, PENETRATING GYPSUM–BOARD PARTITIONS.
      c. STACK SLEEVE FITTINGS: FOR PIPES PENETRATING FLOORS WITH MEMBRANE WATERPROOFING. SECURE FLASHING BETWEEN CLAMPING FLANGES. INSTALL SECTION OF CAST–IRON SOIL PIPE TO EXTEND SLEEVE TO 2 INCHES ABOVE FINISHED FLOOR LEVEL.
         - SEAL SPACE OUTSIDE OF SLEEVE FITTINGS WITH GROUT.
   4. EXCEPT FOR UNDERGROUND WALL PENETRATIONS, SEAL ANNULAR SPACE BETWEEN SLEEVE AND PIPE OR PIPE INSULATION, USING JOINT SEALANTS APPROPRIATE FOR SIZE, DEPTH, AND LOCATION OF JOINT.
J. ABOVEGROUND, EXTERIOR–WALL PIPE PENETRATIONS: SEAL PENETRATIONS USING SLEEVES AND MECHANICAL SLEEVE SEALS. SELECT SLEEVE SIZE TO ALLOW FOR 1–INCH ANNULAR CLEAR SPACE BETWEEN PIPE AND SLEEVE FOR INSTALLING MECHANICAL SLEEVE SEALS.
   1. INSTALL STEEL PIPE FOR SLEEVES SMALLER THAN 6 INCHES IN DIAMETER.
   2. INSTALL CAST–IRON "WALL PIPES" FOR SLEEVES 6 INCHES AND LARGER IN DIAMETER.
   3. MECHANICAL SLEEVE SEAL INSTALLATION: SELECT TYPE AND NUMBER OF SEALING ELEMENTS REQUIRED FOR PIPE MATERIAL AND SIZE. POSITION PIPE IN CENTER OF SLEEVE. ASSEMBLE MECHANICAL SLEEVE SEALS AND INSTALL IN ANNULAR SPACE BETWEEN PIPE AND SLEEVE. TIGHTEN BOLTS AGAINST PRESSURE PLATES THAT CAUSE SEALING ELEMENTS TO EXPAND AND MAKE WATERTIGHT SEAL.
K. UNDERGROUND, EXTERIOR–WALL PIPE PENETRATIONS: INSTALL CAST–IRON "WALL PIPES" FOR SLEEVES. SEAL PIPE PENETRATIONS USING MECHANICAL SLEEVE SEALS. SELECT SLEEVE SIZE TO ALLOW FOR 1–INCH ANNULAR CLEAR SPACE BETWEEN PIPE AND SLEEVE FOR INSTALLING MECHANICAL SLEEVE SEALS.
   1. MECHANICAL SLEEVE SEAL INSTALLATION: SELECT TYPE AND NUMBER OF SEALING ELEMENTS REQUIRED FOR PIPE MATERIAL AND SIZE. POSITION PIPE IN CENTER OF SLEEVE. ASSEMBLE MECHANICAL SLEEVE SEALS AND INSTALL IN ANNULAR SPACE BETWEEN PIPE AND SLEEVE. TIGHTEN BOLTS AGAINST PRESSURE PLATES THAT CAUSE SEALING ELEMENTS TO EXPAND AND MAKE WATERTIGHT SEAL.
L. FIRE–BARRIER PENETRATIONS: MAINTAIN INDICATED FIRE RATING OF WALLS, PARTITIONS, CEILINGS, AND FLOORS AT PIPE PENETRATIONS. SEAL PIPE PENETRATIONS WITH FIRESTOP MATERIALS BASED ON UL REQUIREMENTS.
M. VERIFY FINAL EQUIPMENT LOCATIONS FOR ROUGHING–IN.
N. REFER TO EQUIPMENT SPECIFICATIONS IN OTHER SECTIONS OF THESE SPECIFICATIONS FOR ROUGHING–IN REQUIREMENTS.

3.3 PIPING JOINT CONSTRUCTION

A. JOIN PIPE AND FITTINGS ACCORDING TO THE FOLLOWING REQUIREMENTS AND DIVISION 23 SECTIONS SPECIFYING PIPING SYSTEMS.
B. REAM ENDS OF PIPES AND TUBES AND REMOVE BURRS. BEVEL PLAIN ENDS OF STEEL PIPE.
C. REMOVE SCALE, SLAG, DIRT, AND DEBRIS FROM INSIDE AND OUTSIDE OF PIPE AND FITTINGS BEFORE ASSEMBLY.
D. SOLDERED JOINTS: APPLY ASTM B 813, WATER–FLUSHABLE FLUX, UNLESS OTHERWISE INDICATED, TO TUBE END. CONSTRUCT JOINTS ACCORDING TO ASTM B 828 OR CDA'S "COPPER TUBE HANDBOOK," USING LEAD–FREE SOLDER ALLOY COMPLYING WITH ASTM B 32.
E. BRAZED JOINTS: CONSTRUCT JOINTS ACCORDING TO AWS'S "BRAZING HANDBOOK," "PIPE AND TUBE" CHAPTER, USING COPPER–PHOSPHORUS BRAZING FILLER METAL COMPLYING WITH AWS A5.8.
F. THREADED JOINTS: THREAD PIPE WITH TAPERED PIPE THREADS ACCORDING TO ASME B1.20.1. CUT THREADS FULL AND CLEAN USING SHARP DIES. REAM THREADED PIPE ENDS TO REMOVE BURRS AND RESTORE FULL ID. JOIN PIPE FITTINGS AND VALVES AS FOLLOWS:
   1. APPLY APPROPRIATE TAPE OR THREAD COMPOUND TO EXTERNAL PIPE THREADS UNLESS DRY SEAL THREADING IS SPECIFIED.
   2. DAMAGED THREADS: DO NOT USE PIPE OR PIPE FITTINGS WITH THREADS THAT ARE CORRODED OR DAMAGED. DO NOT USE PIPE SECTIONS THAT HAVE CRACKED OR OPEN WELDS.
G. WELDED JOINTS: CONSTRUCT JOINTS ACCORDING TO AWS D10.12, USING QUALIFIED PROCESSES AND WELDING OPERATORS ACCORDING TO PART 1 "QUALITY ASSURANCE" ARTICLE.
H. FLANGED JOINTS: SELECT APPROPRIATE GASKET MATERIAL, SIZE, TYPE, AND THICKNESS FOR SERVICE APPLICATION. INSTALL GASKET CONCENTRICALLY POSITIONED. USE SUITABLE LUBRICANTS ON BOLT THREADS.
I. PLASTIC PIPING SOLVENT–CEMENT JOINTS: CLEAN AND DRY JOINING SURFACES. JOIN PVC NON–PRESSURE PIPING ACCORDING TO ASTM D 2855. COMPLY WITH ASTM F 402 FOR SAFE–HANDLING PRACTICE OF CLEANERS, PRIMERS, AND SOLVENT CEMENTS.

3.4 PIPING CONNECTIONS

A. MAKE CONNECTIONS ACCORDING TO THE FOLLOWING, UNLESS OTHERWISE INDICATED:
   1. INSTALL UNIONS, IN PIPING NPS 2 AND SMALLER, ADJACENT TO EACH VALVE AND AT FINAL CONNECTION TO EACH PIECE OF EQUIPMENT.
   2. INSTALL FLANGES, IN PIPING NPS 2–1/2 AND LARGER, ADJACENT TO FLANGED VALVES AND AT FINAL CONNECTION TO EACH PIECE OF EQUIPMENT.
   3. DRY PIPING SYSTEMS: INSTALL DIELECTRIC UNIONS AND FLANGES TO CONNECT PIPING MATERIALS OF DISSIMILAR METALS.
   4. WET PIPING SYSTEMS: INSTALL DIELECTRIC COUPLING AND NIPPLE FITTINGS TO CONNECT PIPING MATERIALS OF DISSIMILAR METALS.

3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. INSTALL EQUIPMENT TO ALLOW MAXIMUM POSSIBLE HEADROOM UNLESS SPECIFIC MOUNTING HEIGHTS ARE INDICATED. INSTALL EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS IN EXPOSED INTERIOR SPACES, UNLESS OTHERWISE INDICATED.
B. INSTALL MECHANICAL EQUIPMENT TO FACILITATE SERVICE, MAINTENANCE, AND REPAIR OR REPLACEMENT OF COMPONENTS. CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM INTERFERENCE TO OTHER INSTALLATIONS. EXTEND GREASE FITTINGS TO ACCESSIBLE LOCATIONS.
C. INSTALL EQUIPMENT TO ALLOW RIGHT OF WAY FOR PIPING INSTALLED AT REQUIRED SLOPE.

3.6 EQUIPMENT START–UP

A. STARTUP: CONTRACTOR TO LUBRICATE BEARINGS AS REQUIRED. INSTALL BELTS AND CHECK FOR PROPER BELT TENSION AND MOTOR ROTATION. INSTALL ALL SAFETY DEVICES, AND FILTERS, AND CONNECT ALL DAMPER LINKAGES AND REMOVE ALL SHIPPING HOLD DOWN CLAMPS AND BLOCKING.

3.7 PAINTING

A. DAMAGE AND TOUCH–UP: REPAIR MARRED AND DAMAGED FACTORY–PAINTED FINISHES WITH MATERIALS AND PROCEDURES TO MATCH ORIGINAL FACTORY FINISH.

3.8 CONCRETE BASES

A. CONCRETE BASES: ANCHOR EQUIPMENT TO CONCRETE BASE ACCORDING TO EQUIPMENT MANUFACTURER'S WRITTEN INSTRUCTIONS AND ACCORDING TO SEISMIC CODES AT PROJECT.
   1. CONSTRUCT CONCRETE BASES OF DIMENSIONS INDICATED, BUT NOT LESS THAN 4 INCHES LARGER IN BOTH DIRECTIONS THAN SUPPORTED UNIT.
   2. INSTALL DOWEL RODS TO CONNECT CONCRETE BASE TO CONCRETE FLOOR. UNLESS OTHERWISE INDICATED, INSTALL DOWEL RODS ON 18–INCH CENTERS AROUND THE FULL PERIMETER OF THE BASE.
   3. INSTALL EPOXY–COATED ANCHOR BOLTS FOR SUPPORTED EQUIPMENT THAT EXTEND THROUGH CONCRETE BASE, AND ANCHOR INTO STRUCTURAL CONCRETE FLOOR.
   4. PLACE AND SECURE ANCHORAGE DEVICES. USE SUPPORTED EQUIPMENT MANUFACTURER'S SETTING DRAWINGS, TEMPLATES, DIAGRAMS, INSTRUCTIONS, AND DIRECTIONS FURNISHED WITH ITEMS TO BE EMBEDDED.
   5. INSTALL ANCHOR BOLTS TO ELEVATIONS REQUIRED FOR PROPER ATTACHMENT TO SUPPORTED EQUIPMENT.
   6. INSTALL ANCHOR BOLTS ACCORDING TO ANCHOR–BOLT MANUFACTURER'S WRITTEN INSTRUCTIONS.
   7. USE 3000–PSI, 28–DAY COMPRESSIVE–STRENGTH CONCRETE AND 4 X 4 GALVANIZED WELDED WIRE MESH REINFORCEMENT.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. STRUCTURAL STEEL SHALL COMPLY WITH THE FOLLOWING:
   1. CHANNELS, ANGLES, PLATES AND BARS: ASTM A36.
   2. W–SHAPES: ASTM A992 (GRADE 50).
   3. STEEL TUBING: ASTM A500 (GRADE B).
   4. STEEL PIPE: ASTM A53, E OR S (GRADE B).
B. CUT, FIT, AND PLACE MISCELLANEOUS METAL SUPPORTS ACCURATELY IN LOCATION, ALIGNMENT, AND ELEVATION TO SUPPORT AND ANCHOR MECHANICAL MATERIALS AND EQUIPMENT. FIELD WELDING SHALL COMPLY WITH AWS D1.1.

3.10 GROUTING

A. MIX AND INSTALL GROUT FOR MECHANICAL EQUIPMENT BASE BEARING SURFACES, PUMP AND OTHER EQUIPMENT BASE PLATES, AND ANCHORS. CLEAN SURFACES AND PROVIDE FORMS AS REQUIRED FOR PLACEMENT OF GROUT.
B. AVOID AIR ENTRAPMENT DURING PLACEMENT OF GROUT. PLACE GROUT, COMPLETELY FILLING EQUIPMENT BASES. PLACE GROUT ON CONCRETE BASES AND PROVIDE SMOOTH BEARING SURFACE FOR EQUIPMENT. PLACE GROUT AROUND ANCHORS. CURE PLACED GROUT.

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SUMMARY

A. ALL HVAC DEVICES AND EQUIPMENT SHALL BE SECURELY MOUNTED TO THE BUILDING STRUCTURE AND/OR EXTERIOR CONCRETE PAD (MIN. 4" DEPTH) AND SHALL NOT DEPEND UPON CEILING OR WALL SURFACES FOR THEIR SUPPORT. HVAC EQUIPMENT SHALL BE INCAPABLE OF BEING ROTATED OR DISPLACED. THE SUPPORT ATTACHMENT SHALL ADEQUATELY SUPPORT THE WEIGHT OF THE FIXTURE, DEVICE OR EQUIPMENT PLUS THE WEIGHT OF THE SUPPORT ATTACHMENT. VIBRATION ISOLATION DEVICES SHALL BE INSTALLED TO PREVENT TRANSFER OF EQUIPMENT VIBRATION TO DUCTWORK, PIPING AND BUILDING STRUCTURE. CONCRETE HOUSEKEEPING PADS SHALL BE PROVIDED FOR EQUIPMENT MOUNTED ON CONCRETE PADS EXTERIOR TO THE BUILDING.
B. ALL PIPING SHALL BE SUPPORTED FROM STRUCTURE WITH UL LISTED HANGERS AND SUPPORTS SUITABLE FOR THE INTENDED INSTALLATION. DESIGN, SELECTION, SPACING, AND APPLICATION OF HANGERS AND SUPPORTS SHALL COMPLY WITH ANSI B31.1 AND MSS SP–69.

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1: GENERAL

1.1 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING MECHANICAL IDENTIFICATION MATERIALS AND THEIR INSTALLATION:
   1. EQUIPMENT MARKERS.
   2. ACCESS PANEL AND DOOR MARKERS.
   3. PIPE MARKERS.
   4. VALVE TAGS.
   5. VALVE SCHEDULES.

1.2 SUBMITTALS

A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT INDICATED.
B. VALVE NUMBERING SCHEME.
C. VALVE SCHEDULES: FOR EACH PIPING SYSTEM. FURNISH EXTRA COPIES (IN ADDITION TO MOUNTED COPIES) TO INCLUDE IN MAINTENANCE MANUALS.

1.3 QUALITY ASSURANCE

A. ASME COMPLIANCE: COMPLY WITH ASME A13.1, "SCHEME FOR THE IDENTIFICATION OF PIPING SYSTEMS," FOR LETTER SIZE, LENGTH OF COLOR FIELD, COLORS, AND VIEWING ANGLES OF IDENTIFICATION DEVICES FOR PIPING.

1.4 COORDINATION

A. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH COMPLETION OF COVERING AND PAINTING OF SURFACES WHERE DEVICES ARE TO BE APPLIED.
B. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH LOCATION OF ACCESS PANELS AND DOORS.
C. INSTALL IDENTIFYING DEVICES BEFORE INSTALLING ACOUSTICAL CEILINGS AND SIMILAR CONCEALMENT.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE MANUFACTURERS SPECIFIED.
   1. BRADY CORP.
   2. SETON.
   3. WESTLINE.

2.2 EQUIPMENT IDENTIFICATION DEVICES

A. EQUIPMENT MARKERS: ENGRAVED, LAMINATED PLASTIC WITH BLACK SURFACE AND WHITE CORE. WHEN USED EXPOSED IN FINISHED ROOMS, PROVIDE WHITE SURFACE AND BLACK CORE. UV RATED FOR EXTERIOR EQUIPMENT. INCLUDE CONTACT–TYPE, PERMANENT ADHESIVE.
   1. TERMINOLOGY: MATCH SCHEDULES AS CLOSELY AS POSSIBLE.
   2. DATA:
      a. UNIT MARK/DESIGNATION.
      b. EQUIPMENT SERVICE/AREA SERVED.
   3. SIZE: 2–1/2 BY 4 INCHES FOR CONTROL DEVICES, DAMPERS, AND VALVES; 4–1/2 BY 6 INCHES FOR EQUIPMENT.
B. ACCESS PANEL AND DOOR MARKERS: 1/16–INCH– THICK, ENGRAVED LAMINATED PLASTIC, WHITE SURFACE AND BLACK CORE, WITH ABBREVIATED TERMS AND NUMBERS CORRESPONDING TO IDENTIFICATION. PROVIDE 1/8–INCH CENTER HOLE FOR ATTACHMENT.
   1. FASTENERS: SELF–TAPPING, STAINLESS–STEEL SCREWS.

2.3 PIPING IDENTIFICATION DEVICES

A. MANUFACTURED PIPE MARKERS, GENERAL: PREPRINTED, COLOR–CODED, WITH LETTERING INDICATING SERVICE, AND SHOWING DIRECTION OF FLOW.
   1. COLORS: COMPLY WITH ASME A13.1, UNLESS OTHERWISE INDICATED.
   2. LETTERING:
      a. CHILLED WATER SUPPLY/CHILLED WATER RETURN.
      b. HEATING HOT WATER SUPPLY/HEATING HOT WATER RETURN.
      c. HIGH PRESSURE STEAM.
      d. HIGH PRESSURE CONDENSATE.
      e. MEDIUM PRESSURE STEAM.
      f. MEDIUM PRESSURE CONDENSATE.
      g. LOW PRESSURE STEAM.
      h. LOW PRESSURES CONDENSATE.
      i. PUMPED CONDENSATE.
      j. REFRIGERANT LIQUID.
      k. REFRIGERANT SUCTION.
   3. PIPES WITH OD, INCLUDING INSULATION, LESS THAN 6 INCHES: FULL–BAND PIPE MARKERS EXTENDING 360 DEGREES AROUND PIPE AT EACH LOCATION.
   4. PIPES WITH OD, INCLUDING INSULATION, 6 INCHES AND LARGER: EITHER FULL–BAND OR STRIP–TYPE PIPE MARKERS AT LEAST THREE TIMES LETTER HEIGHT AND OF LENGTH REQUIRED FOR LABEL.
   5. ARROWS: INTEGRAL WITH PIPING SYSTEM SERVICE LETTERING TO ACCOMMODATE BOTH DIRECTIONS; OR AS SEPARATE UNIT ON EACH PIPE MARKER TO INDICATE DIRECTION OF FLOW.
B. PRETENSIONED PIPE MARKERS: PRECOILED SEMI–RIGID PLASTIC FORMED TO COVER FULL CIRCUMFERENCE OF PIPE AND TO ATTACH TO PIPE WITHOUT ADHESIVE.
C. SHAPED PIPE MARKERS: PREFORMED SEMI–RIGID PLASTIC FORMED TO PARTIALLY COVER CIRCUMFERENCE OF PIPE AND TO ATTACH TO PIPE WITH MECHANICAL FASTENERS THAT DO NOT PENETRATE INSULATION VAPOR BARRIER.
D. MARKER DETAILS, O.D. OF LINE OR COVERING (INCHES):
   1. LESS THAN 3/4": 8 INCH LONG COLOR BAND, 1/2" HIGH LETTERS.
   2. 3/4" TO 2": 8 INCH LONG COLOR BAND, 3/4" HIGH LETTERS.
   3. 2–1/2" TO 6": 12 INCH LONG COLOR BAND, 1–1/2" HIGH LETTERS.
   4. OVER 6": 24 INCH LONG COLOR BAND, 2–1/2" HIGH LETTERS.

2.4 VALVE TAGS

A. VALVE TAGS: STAMPED OR ENGRAVED WITH 1/4–INCH LETTERS FOR PIPING SYSTEM ABBREVIATION AND 1/2–INCH NUMBERS, WITH NUMBERING SCHEME. PROVIDE 5/32–INCH HOLE FOR FASTENER.
   1. MATERIAL: 0.032–INCH– THICK BRASS.
   2. VALVE–TAG FASTENERS: BRASS WIRE–LINK OR BEADED CHAIN; OR S–HOOK.

2.5 VALVE SCHEDULES

A. VALVE SCHEDULES: FOR EACH PIPING SYSTEM, ON STANDARD–SIZE BOND PAPER. TABULATE VALVE NUMBER, PIPING SYSTEM, SYSTEM ABBREVIATION (AS SHOWN ON VALVE TAG), LOCATION OF VALVE (ROOM OR SPACE), NORMAL–OPERATING POSITION (OPEN, CLOSED, OR MODULATING), AND VARIATIONS FOR IDENTIFICATION. MARK VALVES FOR EMERGENCY SHUTOFF AND SIMILAR SPECIAL USES.
   1. VALVE–SCHEDULE FRAMES: GLAZED DISPLAY FRAME FOR REMOVABLE MOUNTING ON MASONRY WALLS FOR EACH PAGE OF VALVE SCHEDULE. INCLUDE MOUNTING SCREWS.
   2. FRAME: EXTRUDED ALUMINUM.
   3. GLAZING: ASTM C 1036, TYPE I, CLASS 1, GLAZING QUALITY B, 2.5–MM, SINGLE–THICKNESS GLASS.

PART 3: EXECUTION

3.1 EQUIPMENT IDENTIFICATION

A. INSTALL EQUIPMENT MARKERS WITH PERMANENT ATTACHMENT ON OR NEAR EACH MAJOR ITEM OF MECHANICAL EQUIPMENT.
   1. LETTER SIZE: MINIMUM 1/4 INCH FOR NAME OF UNITS IF VIEWING DISTANCE IS LESS THAN 24 INCHES, 1/2 INCH FOR VIEWING DISTANCES UP TO 72 INCHES, AND PROPORTIONATELY LARGER LETTERING FOR GREATER VIEWING DISTANCES. INCLUDE SECONDARY LETTERING TWO–THIRDS TO THREE–FOURTHS THE SIZE OF PRINCIPAL LETTERING.
   2. DATA: IDENTIFY UNITS, DISTINGUISHING AMONG MULTIPLE UNITS.
   3. LOCATE MARKERS WHERE ACCESSIBLE AND VISIBLE. INCLUDE MARKERS FOR THE FOLLOWING GENERAL CATEGORIES OF EQUIPMENT:
      a. PACKAGED ROOFTOP UNITS.
      b. DYNAMIC AIR CLEANERS.
      c. VAV BOXES.
      d. EXHAUST FANS.
B. INSTALL ACCESS PANEL MARKERS WITH SCREWS ON EQUIPMENT ACCESS PANELS.
   1. STENCIL "FIRE DAMPER" OR "SMOKE DAMPER" ON DUCT ACCESS DOORS TO IDENTIFY FIRE DAMPERS AND SMOKE DAMPERS.

3.2 PIPING IDENTIFICATION

A. INSTALL MANUFACTURED PIPE MARKERS INDICATING SERVICE ON EACH PIPING SYSTEM. INSTALL WITH FLOW INDICATION ARROWS SHOWING DIRECTION OF FLOW.
   1. PIPES WITH OD, INCLUDING INSULATION, LESS THAN 6 INCHES: PRETENSIONED PIPE MARKERS. USE SIZE TO ENSURE A TIGHT FIT.
   2. PIPES WITH OD, INCLUDING INSULATION, 6 INCHES AND LARGER: SHAPED PIPE MARKERS. USE SIZE TO MATCH PIPE AND SECURE WITH FASTENERS.
B. LOCATE PIPE MARKERS WHERE PIPING IS EXPOSED IN FINISHED SPACES; MACHINE ROOMS; ACCESSIBLE MAINTENANCE SPACES SUCH AS SHAFTS, TUNNELS, AND PLENUMS; CEILING SPACES AND UNDER FLOOR AREAS; AND EXTERIOR NON–CONCEALED LOCATIONS AS FOLLOWS:
   1. NEAR EACH VALVE AND CONTROL DEVICE.
   2. NEAR EACH BRANCH CONNECTION, EXCLUDING SHORT TAKEOFFS FOR FIXTURES AND TERMINAL UNITS. WHERE FLOW PATTERN IS NOT OBVIOUS, MARK EACH PIPE AT BRANCH.
   3. NEAR PENETRATIONS THROUGH WALLS, FLOORS, CEILINGS, AND NON–ACCESSIBLE ENCLOSURES.
   4. AT ACCESS DOORS, MANHOLES, AND SIMILAR ACCESS POINTS THAT PERMIT VIEW OF CONCEALED PIPING.
   5. NEAR MAJOR EQUIPMENT ITEMS AND OTHER POINTS OF ORIGINATION AND TERMINATION.
   6. SPACED AT MAXIMUM INTERVALS OF 50 FEET ALONG EACH RUN. REDUCE INTERVALS TO 25 FEET IN AREAS OF CONGESTED PIPING AND EQUIPMENT.

3.3 VALVE–TAG INSTALLATION

A. INSTALL TAGS ON MAIN AND BRANCH SHUT–OFF VALVES AND CONTROL DEVICES IN PIPING SYSTEMS, EXCEPT THE FOLLOWING: CHECK VALVES; VALVES WITHIN FACTORY–FABRICATED EQUIPMENT UNITS; PLUMBING FIXTURE SUPPLY STOPS; SHUTOFF VALVES; FAUCETS; CONVENIENCE AND LAWN–WATERING HOSE CONNECTIONS; AND HVAC TERMINAL DEVICES AND SIMILAR ROUGHING–IN CONNECTIONS OF END–USE FIXTURES AND UNITS. INSTALL VALVE TAGS FOR OTHER VALVES INCLUDING THE FOLLOWING: MAIN SYSTEM SHUTOFF VALVES, VALVES ON PIPING LEAVING CHASES, BRANCH OR RISER SHUTOFF VALVES. LIST TAGGED VALVES IN A VALVE SCHEDULE.
B. VALVE–TAG APPLICATION SCHEDULE: TAG VALVES ACCORDING TO SIZE, SHAPE, AND COLOR SCHEME AND WITH CAPTIONS SIMILAR TO THOSE INDICATED IN THE FOLLOWING:
   1. VALVE–TAG SIZE AND SHAPE:
      a. STEAM: 1–1/2 INCHES, ROUND.
      b. CONDENSATE: 1–1/2 INCHES, ROUND.
      c. CHILLED WATER: 1–1/2 INCHES, ROUND.
      d. HEATING HOT WATER: 1–1/2 INCHES, ROUND.
   2. VALVE–TAG COLOR:
      a. STEAM: NATURAL.
      b. CONDENSATE: NATURAL.
      c. CHILLED WATER: NATURAL.
      d. HEATING HOT WATER: NATURAL.
   3. LETTER COLOR:
      a. STEAM: BLACK.
      b. CONDENSATE: BLACK.
      c. CHILLED WATER: BLACK.
      d. HEATING HOT WATER: BLACK.

3.4 VALVE–SCHEDULE INSTALLATION

A. MOUNT VALVE SCHEDULE ON WALL IN ACCESSIBLE LOCATION IN EACH MAJOR EQUIPMENT ROOM.

3.5 WARNING–TAG INSTALLATION

A. WRITE REQUIRED MESSAGE ON, AND ATTACH WARNING TAGS TO, EQUIPMENT AND OTHER ITEMS WHERE REQUIRED.

3.6 ADJUSTING

A. RELOCATE MECHANICAL IDENTIFICATION MATERIALS AND DEVICES THAT HAVE BECOME VISUALLY BLOCKED BY OTHER WORK.

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1: GENERAL

1.1 SYSTEM BALANCING: BY INDEPENDENT, NEBB CERTIFIED CONTRACTOR

A. TAB CONTRACTOR RESPONSIBILITIES
   1. BALANCING WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE NEBS NATIONAL STANDARDS.
   2. PERFORM A PRE–DEMOLITION BALANCE TO VERIFY SUPPLY, RETURN, AND EXHAUST CAPACITIES OF THE EXISTING SYSTEMS PER FLOOR OR MAJOR DUCT BRANCH.
   3. PROVIDE A PRE–BALANCE REPORT AND IDENTIFY ANY DEFICIENCIES IN THESE SYSTEMS SUCH THAT NEW SYSTEM AIRFLOWS WILL NOT BE OBTAINED. NOTE ANY ADDITIONAL DAMPERS OUTSIDE THE AREA OF WORK THAT ARE REQUIRED FOR BALANCING AND THAT WILL BE PROVIDED BY OWNER.
   4. PERFORM A SYSTEM BALANCE WHEN SYSTEM INSTALLATIONS ARE COMPLETE AND CEILINGS ARE INSTALLED, WHERE CEILINGS ARE REQUIRED. BALANCE SHALL INCLUDE OTHER FLOORS AFFECTED BY CHANGES WITHIN THE PROJECT AREA (I.E. EXHAUST SYSTEMS).
   5. IF A BALANCING DEVICE IS PROVIDED WITH A MEMORY STOP, IT SHALL BE SET AND LOCKED. PERMANENTLY MARK THE SETTINGS TO BE RESTORED.
   6. UPON COMPLETION OF THE WORK, SUBMIT (4) FOUR COPIES OF THE COMPLETE TEST AND BALANCE REPORT.
B. MECHANICAL CONTRACTOR RESPONSIBILITIES
   1. THE MECHANICAL CONTRACTOR IS RESPONSIBLE FOR START UP AND OPERATION OF SYSTEMS DURING SYSTEM BALANCE. START UP SHALL INCLUDE: ALL EQUIPMENT OPERABLE IN SAFE AND NORMAL CONDITION. TEMPERATURE/HUMIDITY CONTROL SYSTEMS INSTALLED COMPLETE AND OPERABLE.
   2. CONTRACTOR SHALL ASSIST TAB CONTRACTOR WITH MECHANICAL SYSTEMS AS REQUIRED TO COMPLETE BALANCE WORK.
   3. HVAC CONTROLS CONTRACTOR SHALL ASSIST TAB CONTRACTOR WITH CONTROLS AS REQUIRED TO COMPLETE BALANCE WORK.

SECTION 230700 – HVAC INSULATION

PART 1: GENERAL

1.1 SUMMARY

A. THIS SECTION INCLUDES MECHANICAL INSULATION FOR DUCT AND PIPE INCLUDING THE FOLLOWING: INSULATION MATERIALS, INSULATING CEMENTS, ADHESIVES, MASTICS, SEALANTS, FACTORY–APPLIED JACKETS, FIELD–APPLIED FABRIC–REINFORCING MESH, FIELD–APPLIED JACKETS, TAPES, SECUREMENTS, CORNER ANGLES.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: N/A

MECHANICAL SPECIFICATIONS

SHEET NO.: M0.02

1.2 QUALITY ASSURANCE
A. FIRE-TEST-RESPONSE CHARACTERISTICS: INSULATION AND RELATED MATERIALS SHALL HAVE FIRE-TEST-RESPONSE CHARACTERISTICS INDICATED, AS DETERMINED BY TESTING IDENTICAL PRODUCTS PER ASTM E 84, BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION. FACTORY LABEL INSULATION AND JACKET MATERIALS AND ADHESIVE, MASTIC, AND CEMENT MATERIAL CONTAINERS, WITH APPROPRIATE MARKINGS OF APPLICABLE TESTING AND INSPECTING AGENCY.
1. FLAME-SPREAD INDEX OF 25 OR LESS, AND SMOKE-DEVELOPED INDEX OF 50 OR LESS.

PART 2: PRODUCTS

2.1 MANUFACTURERS
A. MANUFACTURERS – INSULATION MATERIALS:
1. CERTAIN TEED CORP.
2. JOHNS MANVILLE.
3. KNAUF INSULATION.
4. OWENS CORNING.
B. MANUFACTURERS – INSULATING CEMENTS:
1. INSULCO, DIVISION OF MFS, INC.
2. P. K. INSULATION MFG. CO., INC.
3. ROCK WOOL MANUFACTURING COMPANY.
C. MANUFACTURERS – ADHESIVES, MASTICS, SEALANTS.
1. CHILDERS PRODUCTS, DIVISION OF ITW.
2. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY.
3. ITW TACC, DIVISION OF ILLINOIS TOOL WORKS.
4. MON-ECO INDUSTRIES.
5. VIMASCO CORPORATION.
D. MANUFACTURERS – FIELD-APPLIED CLOTHES.
1. ALPHA ASSOCIATES, INC. OR APPROVED EQUAL.
E. MANUFACTURERS – FIELD APPLIED JACKETS.
1. CHILDERS PRODUCTS, DIVISION OF ITW; METAL JACKETING SYSTEMS.
2. PABCO METALS CORPORATION; SUREFIT.
3. RPR PRODUCTS, INC.; INSUL-MATE.

2.2 INSULATION MATERIALS
A. MINERAL-FIBER BLANKET INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 553, TYPE II AND ASTM C 1290, TYPE III WITH FACTORY-APPLIED FSK JACKET.
B. MINERAL-FIBER BOARD INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 612, TYPE IA OR TYPE IB. FOR DUCT AND PLENUM APPLICATIONS, PROVIDE INSULATION WITH FACTORY-APPLIED FSK JACKET.
C. MINERAL-FIBER, PREFORMED PIPE INSULATION: TYPE I, 850 DEG F MATERIALS: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 547, TYPE I, GRADE A, WITH FACTORY-APPLIED ASJ OR WITH FACTORY-APPLIED ASJ-SSL.
D. MINERAL-FIBER, PIPE AND TANK INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. SEMIRIGID BOARD MATERIAL WITH FACTORY-APPLIED ASJ COMPLYING WITH ASTM C 1393, TYPE II OR TYPE IIIA CATEGORY 2, OR WITH PROPERTIES SIMILAR TO ASTM C 612, TYPE IB. NOMINAL DENSITY IS 2.5 LB/CU. FT. OR MORE. THERMAL CONDUCTIVITY (K-VALUE) AT 100 DEG F IS 0.29 BTU-IN./(H-SQ. FT.-°F) OR LESS.

2.3 INSULATION CEMENTS
A. MINERAL-FIBER, HYDRAULIC-SETTING INSULATING AND FINISHING CEMENT: COMPLY WITH ASTM C 449/C 449M.

2.4 ADHESIVES
A. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES AND FOR BONDING INSULATION TO ITSELF AND TO SURFACES TO BE INSULATED, UNLESS OTHERWISE INDICATED.
B. ASJ ADHESIVE, AND FSK JACKET ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A FOR BONDING INSULATION JACKET LAP SEAMS AND JOINTS.
C. MINERAL-FIBER ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A.

2.5 MASTICS
A. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES: COMPLY WITH MIL-C-19565C, TYPE II.
B. VAPOR-BARRIER MASTIC: WATER BASED; SUITABLE FOR INDOOR AND OUTDOOR USE ON BELOW AMBIENT SERVICES. WATER-VAPOR PERMEANCE SHALL BE ASTM E 96, PROCEDURE B, 0.013 PERM AT 43-MIL DRY FILM THICKNESS. SERVICE TEMPERATURE RANGE SHALL BE MINUS 20 TO PLUS 180 DEG F. SOLIDS CONTENT SHALL BE ASTM D 1644, 59 PERCENT BY VOLUME AND 71 PERCENT BY WEIGHT. COLOR SHALL BE WHITE.
C. BREATHER MASTIC: WATER BASED; SUITABLE FOR INDOOR AND OUTDOOR USE ON ABOVE AMBIENT SERVICES. WATER-VAPOR PERMEANCE SHALL BE ASTM F 1249, 3 PERMS AT 0.0625-INCH DRY FILM THICKNESS. SERVICE TEMPERATURE RANGE SHALL BE MINUS 20 TO PLUS 200 DEG F. SOLIDS CONTENT SHALL BE 63 PERCENT BY VOLUME AND 73 PERCENT BY WEIGHT. COLOR SHALL BE WHITE.

2.6 SEALANTS
A. JOINT SEALANTS: MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES. PERMANENTLY FLEXIBLE, ELASTOMERIC SEALANT SERVICE TEMPERATURE RANGE SHALL BE MINUS 100 TO PLUS 300 DEG F. COLOR SHALL BE WHITE OR GRAY.
B. FSK AND METAL JACKET FLASHING SEALANTS: MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES. FIRE-AND WATER-RESISTANT, FLEXIBLE, ELASTOMERIC SEALANT. SERVICE TEMPERATURE RANGE SHALL BE MINUS 40 TO PLUS 250 DEG F. COLOR SHALL BE ALUMINUM.
C. ASJ FLASHING SEALANTS, AND VINYL, PVDC, AND PVC JACKET FLASHING SEALANTS: MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES. FIRE- AND WATER-RESISTANT, FLEXIBLE, ELASTOMERIC SEALANT. SERVICE TEMPERATURE RANGE SHALL BE MINUS 40 TO PLUS 250 DEG F. COLOR SHALL BE WHITE.

2.7 FACTORY-APPLIED JACKETS
A. INSULATION SYSTEM SCHEDULES INDICATE FACTORY-APPLIED JACKETS ON VARIOUS APPLICATIONS. WHEN FACTORY-APPLIED JACKETS ARE INDICATED, COMPLY WITH THE FOLLOWING:
1. FSK JACKET: ALUMINUM-FOIL, FIBERGLASS-REINFORCED SCRIM WITH KRAFT-PAPER BACKING; COMPLYING WITH ASTM C 1136, TYPE II.
2. ASJ: WHITE, KRAFT-PAPER, FIBERGLASS-REINFORCED SCRIM WITH ALUMINUM-FOIL BACKING; COMPLYING WITH ASTM C 1136, TYPE I.
3. ASJ-SSL: ASJ WITH SELF-SEALING, PRESSURE-SENSITIVE, ACRYLIC-BASED ADHESIVE COVERED BY A REMOVABLE PROTECTIVE STRIP; COMPLYING WITH ASTM C 1136, TYPE I.

2.8 FIELD-APPLIED CLOTHES
A. WOVEN GLASS-FIBER FABRIC: COMPLY WITH MIL-C-20079H, TYPE I, PLAIN WEAVE, AND PRESIZED A MINIMUM OF 8 OZ./SQ. YD.

2.9 FIELD-APPLIED JACKETS
A. FIELD-APPLIED JACKETS SHALL COMPLY WITH ASTM C 921, TYPE I, UNLESS OTHERWISE INDICATED.
B. ALUMINUM JACKET: COMPLY WITH ASTM B 209, ALLOY 3003, 3005, 3105 OR 5005, TEMPER H-14. SHEET AND ROLL STOCK SHALL BE READY FOR SHOP OR FIELD SIZING. FINISH AND THICKNESS ARE INDICATED IN FIELD-APPLIED JACKET SCHEDULES. MOISTURE BARRIER FOR INDOOR APPLICATIONS SHALL BE 1-MIL- THICK, HEAT-BONDED POLYETHYLENE AND KRAFT PAPER. MOISTURE BARRIER FOR OUTDOOR APPLICATIONS SHALL BE 3-MIL- THICK, HEAT-BONDED POLYETHYLENE AND KRAFT PAPER. FACTORY-FABRICATED FITTING COVERS SHALL BE:
1. SAME MATERIAL, FINISH, AND THICKNESS AS JACKET.
2. FIELD FABRICATE FITTING COVERS ONLY IF FACTORY-FABRICATED FITTING COVERS ARE NOT AVAILABLE.
3. PREFORMED 2-PIECE OR GORE, 45 AND 90 DEGREE, SHORT AND LONG RADIUS ELBOWS.
4. TEE COVERS.
5. FLANGE AND UNION COVERS.
6. END CAPS.
7. BEVELED COLLARS.
8. VALVE COVERS.
C. FSK JACKET: ALUMINUM-FOIL-FACE, FIBERGLASS-REINFORCED SCRIM WITH KRAFT-PAPER BACKING.
D. PVC JACKET: HIGH IMPACT RESISTANT, UV RESISTANT PVC COMPLYING WITH ASTM D 1784, CLASS 16354-C. ADHESIVE AS RECOMMENDED BY JACKET MATERIAL MANUFACTURER. WHITE IN COLOR.
1. FACTORY FABRICATED FITTING COVERS: PREFORMED SHAPES FOR ELBOWS, TEES, VALVES, FLANGES, UNIONS, REDUCERS, AND STRAINERS.

2.10 TAPES
A. FSK TAPE: FOIL-FACE, VAPOR-RETARDER TAPE MATCHING FACTORY-APPLIED JACKET WITH ACRYLIC ADHESIVE; COMPLYING WITH ASTM C 1136 AND UL LISTED. TAPE SHALL HAVE CHARACTERISTICS AS FOLLOWS: 3 INCH WIDTH, 6.5 MIL THICKNESS, 90 OUNCES FORCE/INCH IN WIDTH ADHESION, 2 PERCENT ELONGATION, AND 40 LBF/INCH IN WIDTH TENSILE STRENGTH.
B. ASJ TAPE: WHITE VAPOR-RETARDER TAPE MATCHING FACTORY-APPLIED JACKET WITH ACRYLIC ADHESIVE, COMPLYING WITH ASTM C 1136 AND UL LISTED. TAPE SHALL HAVE CHARACTERISTICS AS FOLLOWS: 3 INCH WIDTH, 11.5 MILS THICKNESS, 90 OUNCES FORCE/INCH IN WIDTH ADHESION, 2 PERCENT ELONGATION, AND 40 LBF/INCH IN WIDTH TENSILE STRENGTH.
C. ALUMINUM-FOIL TAPE: VAPOR-RETARDER TAPE WITH ACRYLIC ADHESIVE AND UL LISTED. TAPE SHALL HAVE CHARACTERISTICS AS FOLLOWS: 2 INCH WIDTH, 3.7 MILS THICKNESS, 100 OUNCES FORCE/INCH IN WIDTH ADHESION, 5 PERCENT ELONGATION, AND 34 LBF/INCH IN WIDTH TENSILE STRENGTH.

2.11 SECUREMENTS
A. ALUMINUM BANDS: ASTM B 209, ALLOY 3003, 3005, 3105, OR 5005; TEMPER H-14, 0.020 INCH THICK, 3/4 INCH WIDE WITH WING SEAL.
B. METAL, ADHESIVELY ATTACHED, PERFORATED-BASE INSULATION HANGERS: BASEPLATE WELDED TO PROJECTING SPINDLE THAT IS CAPABLE OF HOLDING INSULATION, OF THICKNESS INDICATED, SECURELY IN POSITION INDICATED WHEN SELF-LOCKING WASHER IS IN PLACE. COMPLY WITH THE FOLLOWING REQUIREMENTS:
1. BASEPLATE: PERFORATED, GALVANIZED CARBON-STEEL SHEET, 0.030 INCH THICK BY 2 INCHES SQUARE.
2. SPINDLE: COPPER- OR ZINC-COATED, LOW CARBON STEEL, FULLY ANNEALED, 0.106-INCH- DIAMETER SHANK, LENGTH TO SUIT DEPTH OF INSULATION INDICATED.
3. ADHESIVE: RECOMMENDED BY HANGER MANUFACTURER. PRODUCT WITH DEMONSTRATED CAPABILITY TO BOND INSULATION HANGER SECURELY TO SUBSTRATES INDICATED WITHOUT DAMAGING INSULATION, HANGERS, AND SUBSTRATES.
C. INSULATION-RETAINING WASHERS: SELF-LOCKING WASHERS FORMED FROM 0.016-INCH- THICK, GALVANIZED-STEEL SHEET, WITH BEVELED EDGE SIZED AS REQUIRED TO HOLD INSULATION SECURELY IN PLACE BUT NOT LESS THAN 1-1/2 INCHES IN DIAMETER.
1. PROTECT ENDS WITH CAPPED SELF-LOCKING WASHERS INCORPORATING A SPRING STEEL INSERT TO ENSURE PERMANENT RETENTION OF CAP IN EXPOSED LOCATIONS.
D. STAPLES: OUTWARD-CLINCHING INSULATION STAPLES, NOMINAL 3/4-INCH- WIDE, STAINLESS STEEL OR MONEL.
E. WIRE: 0.062-INCH SOFT-ANNEALED, STAINLESS STEEL.

2.12 CORNER ANGLES
A. ALUMINUM CORNER ANGLES: 0.040 INCH THICK, MINIMUM 1 BY 1 INCH, ALUMINUM ACCORDING TO ASTM B 209, ALLOY 3003, 3005, 3105 OR 5005; TEMPER H-14.

PART 3: EXECUTION

3.1 DUCT AND PLENUM INSULATION INSTALLATION
A. BLANKET INSULATION INSTALLATION ON DUCTS AND PLENUMS: SECURE WITH INSULATION PINS.
1. INSTALL EITHER CAPACITOR-DISCHARGE-WELD PINS AND SPEED WASHERS OR CUPPED-HEAD, CAPACITOR-DISCHARGE-WELD PINS ON SIDES AND BOTTOM OF HORIZONTAL DUCTS AND SIDES OF VERTICAL DUCTS AS FOLLOWS:
a. ON DUCT SIDES WITH DIMENSIONS LARGER THAN 18 INCHES, PLACE PINS 12 INCHES O.C. EACH WAY, AND 3 INCHES MAXIMUM FROM INSULATION JOINTS. INSTALL ADDITIONAL PINS TO HOLD INSULATION TIGHTLY AGAINST SURFACE AT CROSS BRACING. PINS MAY BE OMITTED FROM TOP SURFACE OF HORIZONTAL, RECTANGULAR DUCTS AND PLENUMS.
b. DO NOT OVERCOMPRESS INSULATION DURING INSTALLATION.
c. IMPALE INSULATION OVER PINS AND ATTACH SPEED WASHERS. CUT EXCESS PORTION OF PINS EXTENDING BEYOND SPEED WASHERS OR BEND PARALLEL WITH INSULATION SURFACE. COVER EXPOSED PINS AND WASHERS WITH TAPE MATCHING INSULATION FACING.
2. INSTALL INSULATION ON RECTANGULAR DUCT ELBOWS AND TRANSITIONS WITH A FULL INSULATION SECTION FOR EACH SURFACE.
3. INSULATE DUCT STIFFENERS, HANGERS, AND FLANGES THAT PROTRUDE BEYOND INSULATION SURFACE WITH 6 INCH-WIDE STRIPS OF SAME MATERIAL USED TO INSULATE DUCT. SECURE ON ALTERNATING SIDES OF STIFFENER, HANGER, AND FLANGE WITH PINS SPACED 6 INCHES O.C.

B. BOARD INSULATION INSTALLATION ON DUCTS AND PLENUMS: SECURE WITH INSULATION PINS.
1. INSTALL EITHER CAPACITOR-DISCHARGE-WELD PINS AND SPEED WASHERS OR CUPPED-HEAD, CAPACITOR-DISCHARGE-WELD PINS ON SIDES AND BOTTOM OF HORIZONTAL DUCTS AND SIDES OF VERTICAL DUCTS AS FOLLOWS:
a. ON DUCT SIDES WITH DIMENSIONS 18 INCHES AND SMALLER, PLACE PINS ALONG LONGITUDINAL CENTERLINE OF DUCT. SPACE 3 INCHES MAXIMUM FROM INSULATION END JOINTS, AND 12 INCHES O.C.
b. ON DUCT SIDES WITH DIMENSIONS LARGER THAN 18 INCHES, SPACE PINS 12 INCHES O.C. EACH WAY, AND 3 INCHES MAXIMUM FROM INSULATION JOINTS. INSTALL ADDITIONAL PINS TO HOLD INSULATION TIGHTLY AGAINST SURFACE AT CROSS BRACING.
c. PINS MAY BE OMITTED FROM TOP SURFACE OF HORIZONTAL, RECTANGULAR DUCTS AND PLENUMS.
d. DO NOT OVERCOMPRESS INSULATION DURING INSTALLATION.
e. CUT EXCESS PORTION OF PINS EXTENDING BEYOND SPEED WASHERS OR BEND PARALLEL WITH INSULATION SURFACE. COVER EXPOSED PINS AND WASHERS WITH TAPE MATCHING INSULATION FACING.
2. INSTALL INSULATION ON RECTANGULAR DUCT ELBOWS AND TRANSITIONS WITH A FULL INSULATION SECTION FOR EACH SURFACE. GROOVE AND SCORE INSULATION TO FIT AS CLOSELY AS POSSIBLE TO OUTSIDE AND INSIDE RADIUS OF ELBOWS.
3. INSULATE DUCT STIFFENERS, HANGERS, AND FLANGES THAT PROTRUDE BEYOND INSULATION SURFACE WITH 6-INCH-WIDE STRIPS OF SAME MATERIAL USED TO INSULATE DUCT. SECURE ON ALTERNATING SIDES OF STIFFENER, HANGER, AND FLANGE WITH PINS SPACED 6 INCHES O.C.
C. VAPOR BARRIER FOR DUCTS AND PLENUM INSULATION
1. FOR DUCTS AND PLENUMS WITH SURFACE TEMPERATURES BELOW AMBIENT, INSTALL A CONTINUOUS UNBROKEN VAPOR BARRIER. CREATE A FACING LAP FOR LONGITUDINAL SEAMS AND END JOINTS WITH INSULATION BY REMOVING 3 INCHES FROM 1 EDGE AND 1 END OF INSULATION SEGMENT. SECURE LAPS TO ADJACENT INSULATION SECTION WITH 1/2-INCH OUTWARD-CLINCHING STAPLES, 1 INCH O.C. INSTALL VAPOR BARRIER CONSISTING OF FACTORY- OR FIELD-APPLIED JACKET, ADHESIVE, VAPOR-BARRIER MASTIC, AND SEALANT AT JOINTS, SEAMS, AND PROTRUSIONS.
a. REPAIR PUNCTURES, TEARS, AND PENETRATIONS WITH TAPE OR MASTIC TO MAINTAIN VAPOR-BARRIER SEAL.
b. INSTALL VAPOR STOPS FOR DUCTWORK AND PLENUMS OPERATING BELOW 50 DEG F AT 18-FOOT INTERVALS. VAPOR STOPS SHALL CONSIST OF VAPOR-BARRIER MASTIC APPLIED IN A Z-SHAPED PATTERN OVER INSULATION FACE, ALONG BUTT END OF INSULATION, AND OVER THE SURFACE. COVER INSULATION FACE AND SURFACE TO BE INSULATED A WIDTH EQUAL TO 2 TIMES THE INSULATION THICKNESS BUT NOT LESS THAN 3 INCHES.

3.2 PIPE INSULATION
A. SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, INCLUDING COVERAGE RATES, MASTICS, ADHESIVES AND COATINGS TO BE USED. INSULATION SHALL BE APPLIED TO PROVIDE FULL INSULATION THICKNESS ON ALL SURFACES, INCLUDING CORNERS AND BENDS.
B. INSULATION SHALL BE APPLIED TO CLEAN, DRY SURFACES. REMOVE ALL MILL SCALE, GREASE OR DIRT. INSULATION SHALL NOT BE APPLIED TO PIPING AND EQUIPMENT UNTIL ALL REQUIRED TESTING HAS BEEN COMPLETED AND ALL NECESSARY REPAIRS HAVE BEEN MADE.
C. INSTALL PIPING INSULATION MATERIALS AFTER PIPING HAS BEEN TESTED AND APPROVED. CONTINUE INSULATION WITH VAPOR BARRIER THROUGH PENETRATIONS. IN EXPOSED PIPING, LOCATE INSULATION AND COVER SEAMS IN LEAST VISIBLE LOCATIONS. NEATLY FINISH INSULATION AT SUPPORTS, PROTRUSIONS AND INTERRUPTIONS. PIPE INSULATION SHALL BE INSTALLED WITH JOINTS BUTTED FIRMLY TOGETHER. NO EXCEPTIONS.
D. MATERIALS SHALL BE APPLIED BY A QUALIFIED INSULATION APPLICATOR / WORKMAN SKILLED IN THIS TRADE. INSULATION SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY STANDARDS. MECHANICAL FASTENERS SHALL BE USED WHENEVER POSSIBLE TO ASSURE PERMANENT CONSTRUCTION. UNSIGHTLY WORK SHALL BE A CAUSE FOR REJECTION.
E. NON-COMPRESSIBLE INSULATION MATERIAL SHALL BE INSTALLED AT HANGER SUPPORTS TO PREVENT DAMAGE TO INSULATION AND VAPOR BARRIER.
F. MINIMUM THICKNESS OF INSULATION SHALL BE AS SCHEDULED; HOWEVER, SUFFICIENT INSULATION SHALL BE PROVIDED TO ELIMINATE CONDENSATION ON COLD SURFACES, AND TO MAINTAIN A MAXIMUM EXTERIOR INSULATION SURFACE TEMPERATURE OF 125 DEG. FOR HOT PIPING.
G. COVER ALL VALVES, STRAINERS, UNIONS, FLANGES AND FITTINGS WITH PVC FITTING COVERS.
H. INSTALL PROTECTIVE METAL SHIELDS WHERE PIPE HANGERS BEAR ON THE OUTSIDE OF INSULATION. PROVIDE WOOD BLOCKING FROM THE SHIELD THROUGH THE INSULATION OR O.C. KAYLO (MINIMUM 24" LONG) TO PREVENT CRUSHING OF THE INSULATION.

3.3 FIELD-APPLIED CLOTHS
A. WHERE WOVEN GLASS-FIBER FABRIC IS INDICATED, INSTALL AS FOLLOWS: BRUSH ON INSULATING CEMENT OVER ENTIRE SURFACE AND COVER WITH WOVEN GLASS-FIBER FABRIC. FABRIC SHALL BE DRAWN TIGHT SO SURFACE IS SMOOTH AND WITHOUT WRINKLES. BRUSH ON A TOP LAYER OF INSULATING CEMENT OVER THE ENTIRE AREA.

3.4 FIELD-APPLIED JACKET INSTALLATION
A. WHERE METAL JACKETS ARE INDICATED, INSTALL WITH 2-INCH OVERLAP AT LONGITUDINAL SEAMS AND END JOINTS. OVERLAP LONGITUDINAL SEAMS ARRANGED TO SHED WATER. SEAL END JOINTS WITH WEATHERPROOF SEALANT RECOMMENDED BY INSULATION MANUFACTURER. SECURE JACKET WITH STAINLESS-STEEL BANDS 12 INCHES O.C. AND AT END JOINTS.

3.5 FIELD QUALITY CONTROL
A. PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS:
3. INSPECT DUCTWORK, RANDOMLY SELECTED BY ENGINEER, BY REMOVING FIELD-APPLIED JACKET AND INSULATION IN LAYERS IN REVERSE ORDER OF THEIR INSTALLATION. EXTENT OF INSPECTION SHALL BE LIMITED TO TWO LOCATIONS FOR EACH DUCT SYSTEM DEFINED IN THE "DUCT INSULATION SCHEDULE, GENERAL" ARTICLE.
B. ALL INSULATION APPLICATIONS WILL BE CONSIDERED DEFECTIVE WORK IF SAMPLE INSPECTION REVEALS NONCOMPLIANCE WITH REQUIREMENTS. REMOVE DEFECTIVE WORK.
C. INSTALL NEW INSULATION AND JACKETS TO REPLACE INSULATION AND JACKETS REMOVED FOR INSPECTION. REPEAT INSPECTION PROCEDURES AFTER NEW MATERIALS ARE INSTALLED.

3.6 DUCT AND PLENUM INSULATION SCHEDULE
A. PLENUMS AND DUCTS REQUIRING INSULATION: SEE DUCT INSULATION SCHEDULE.
B. ITEMS NOT INSULATED:
1. FACTORY-INSULATED FLEXIBLE DUCTS.
2. FACTORY-INSULATED PLENUMS AND CASINGS.
3. FLEXIBLE CONNECTORS.
4. VIBRATION-CONTROL DEVICES.
5. FACTORY-INSULATED ACCESS PANELS AND DOORS.

3.7 FIELD-APPLIED JACKET SCHEDULE
A. INSTALL JACKET OVER INSULATION MATERIAL. FOR INSULATION WITH FACTORY-APPLIED JACKET, INSTALL THE FIELD-APPLIED JACKET OVER THE FACTORY-APPLIED JACKET.
B. DUCTS AND PLENUMS, EXPOSED IN MECHANICAL EQUIPMENT ROOMS AND OTHER NON-CONDITIONED AREAS:
1. WOVEN GLASS-FIBER FABRIC WITH INSULATING CEMENT.
C. DUCTS AND PLENUMS, EXPOSED IN AIR-CONDITIONED AREAS:
1. WOVEN GLASS-FIBER FABRIC WITH INSULATING CEMENT.
D. DUCTS AND PLENUMS, EXPOSED OUTDOORS:
1. WOVEN GLASS-FIBER FABRIC WITH INSULATING CEMENT.
2. ALUMINUM, SMOOTH, 0.016 INCH THICK.

SECTION 233113 – METAL DUCTS

PART 1: GENERAL

1.1 SUMMARY
B. THIS SECTION INCLUDES METAL DUCTS FOR SUPPLY, RETURN, OUTSIDE, AND EXHAUST AIR-DISTRIBUTION SYSTEMS IN PRESSURE CLASSES FROM MINUS 2- TO PLUS 10-INCH WG. METAL DUCTS INCLUDE THE FOLLOWING:
1. RECTANGULAR DUCTS AND FITTINGS.
2. SINGLE-WALL, ROUND, AND FLAT-OVAL SPIRAL-SEAM DUCTS AND FORMED FITTINGS.

1.2 SYSTEM DESCRIPTION
A. DUCT SYSTEM DESIGN, AS INDICATED, HAS BEEN USED TO SELECT SIZE AND TYPE OF AIR-MOVING AND AIR-DISTRIBUTION EQUIPMENT AND OTHER AIR SYSTEM COMPONENTS. CHANGES TO LAYOUT OR CONFIGURATION OF DUCT SYSTEM MUST BE SPECIFICALLY APPROVED IN WRITING BY ENGINEER. ACCOMPANY REQUESTS FOR LAYOUT MODIFICATIONS WITH CALCULATIONS SHOWING THAT PROPOSED LAYOUT WILL PROVIDE ORIGINAL DESIGN RESULTS WITHOUT INCREASING SYSTEM TOTAL PRESSURE.

1.3 SUBMITTALS
A. PRODUCT DATA: SUBMIT PRODUCT DATA ON MANUFACTURED DUCTS AND FITTINGS.

1.4 QUALITY ASSURANCE
A. WELDING: QUALIFY PROCEDURES AND PERSONNEL ACCORDING TO AWS D1.1, "STRUCTURAL WELDING CODE--STEEL," FOR HANGERS AND SUPPORTS; AWS D1.2, "STRUCTURAL WELDING CODE--ALUMINUM," FOR ALUMINUM SUPPORTING MEMBERS; AND AWS D9.1, "SHEET METAL WELDING CODE," FOR DUCT JOINT AND SEAM WELDING.
B. NFPA COMPLIANCE:
1. NFPA 90A, "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS."
2. NFPA 90B, "INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS."

PART 2: PRODUCTS

2.1 MANUFACTURERS
A. TRANSVERSE JOINTS:
1. DUCTMATE INDUSTRIES, INC.
2. NEXUS INC.
3. WARD INDUSTRIES, INC.
B. FORMED-ON FLANGES;
1. DUCTMATE INDUSTRIES, INC.
2. LOCKFORMER.
C. ROUND AND FLAT OVAL DUCT AND FITTINGS:
1. MCGILL AIRFLOW CORPORATION.
2. SEMCO INCORPORATED.

2.2 SHEET METAL MATERIALS
A. COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE" FOR ACCEPTABLE MATERIALS, MATERIAL THICKNESSES, AND DUCT CONSTRUCTION METHODS, UNLESS OTHERWISE INDICATED. SHEET METAL MATERIALS SHALL BE FREE OF PITTING, SEAM MARKS, ROLLER MARKS, STAINS, DISCOLORATIONS, AND OTHER IMPERFECTIONS.
B. GALVANIZED SHEET STEEL: ASTM A 653/A 653M, LOCK-FORMING QUALITY, G60 COATING DESIGNATION; MILL-PHOSPHATIZED FINISH FOR SURFACES EXPOSED TO VIEW.
C. CARBON-STEEL SHEETS: ASTM A 366/A 366M, COLD-ROLLED SHEETS; COMMERCIAL QUALITY; WITH OILED, MATTE FINISH FOR EXPOSED DUCTS.
D. STAINLESS STEEL: ASTM A 480/A 480M, TYPE 316 OR 304 AS INDICATED, AND HAVING A NO. 2D FINISH FOR CONCEALED DUCTS AND A NO. 2B FINISH FOR EXPOSED DUCTS.
E. ALUMINUM SHEETS: ASTM B 209, ALLOY 3003, TEMPER H14; WITH AMILL FINISH FOR CEONCEALED DUCTS AND EXPOSED DUCTS.

2.3 SEALANT MATERIALS
A. JOINT AND SEAM SEALANTS, GENERAL: THE TERM "SEALANT" IS NOT LIMITED TO MATERIALS OF ADHESIVE OR MASTIC NATURE BUT INCLUDES TAPES AND COMBINATIONS OF OPEN-WEAVE FABRIC STRIPS AND MASTICS.
B. TAPE SEALING SYSTEM: WOVEN-FIBER TAPE IMPREGNATED WITH GYPSUM MINERAL COMPOUND AND MODIFIED ACRYLIC/SILICONE ACTIVATOR TO REACT EXOTHERMICALLY WITH TAPE TO FORM HARD, DURABLE, AIRTIGHT SEAL.
C. WATER-BASED JOINT AND SEAM SEALANT: FLEXIBLE, ADHESIVE SEALANT, RESISTANT TO UV LIGHT WHEN CURED, UL 723 LISTED, AND COMPLYING WITH NFPA REQUIREMENTS FOR CLASS 1 DUCTS.
D. SOLVENT-BASED JOINT AND SEAM SEALANT: ONE-PART, NON-SAG, SOLVENT-RELEASE-CURING, POLYMERIZED BUTYL SEALANT FORMULATED WITH A MINIMUM OF 75 PERCENT SOLIDS.
E. FLANGED JOINT MASTIC: ONE-PARTD. SOLVENT-BASED JOINT AND SEAM SEALANT: ONE-PART, NON-SAG, SOLVENT-RELEASE-CURING, POLYMERIZED BUTYL SEALANT FORMULATED WITH A MINIMUM OF 75 PERCENT SOLIDS.
F. FLANGE GASKETS: BUTYL RUBBER OR EPDM POLYMER WITH POLYISOBUTYLENE PLASTICIZER.

2.4 HANGERS AND SUPPORTS
A. BUILDING ATTACHMENTS: CONCRETE INSERTS OR STRUCTURAL-STEEL FASTENERS APPROPRIATE FOR CONSTRUCTION MATERIALS TO WHICH HANGERS ARE BEING ATTACHED.
B. HANGER MATERIALS: MATERIALS SHALL BE COMPATIBLE WITH DUCT MATERIALS. GALVANIZED SHEET STEEL OR THREADED STEEL ROD FOR GALVANIZED-STEEL DUCTS.
1. HANGERS/SUPPORTS INSTALLED OUTDOORS: ELECTRO-GALVANIZED, ALL-THREAD RODS OR GALVANIZED RODS WITH THREADS PAINTED WITH ZINC-CHROMATE PRIMER AFTER INSTALLATION.
2. STRAP AND ROD SIZES: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE" FOR STEEL SHEET WIDTH AND THICKNESS AND FOR STEEL ROD DIAMETERS.
C. DUCT ATTACHMENTS: SHEET METAL SCREWS OR SELF-TAPPING METAL SCREWS; COMPATIBLE WITH DUCT MATERIALS.
D. TRAPEZE AND RISER SUPPORTS: STEEL SHAPES COMPLYING WITH ASTM A 36/A 36M.
1. SUPPORTS FOR GALVANIZED-STEEL DUCTS: GALVANIZED-STEEL SHAPES AND PLATES.
2. SUPPORTS FOR STAINLESS-STEEL DUCTS: STAINLESS-STEEL SUPPORT MATERIALS.
3. SUPPORTS FOR ALUMINUM DUCTS: ALUMINUM SUPPORT MATERIALS.

2.5 RECTANGULAR DUCT FABRICATION
A. FABRICATE DUCTS, ELBOWS, TRANSITIONS, OFFSETS, BRANCH CONNECTIONS, AND OTHER CONSTRUCTION ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE" AND COMPLYING WITH REQUIREMENTS FOR METAL THICKNESS, REINFORCING TYPES AND INTERVALS, TIE-ROD APPLICATIONS, AND JOINT TYPES AND INTERVALS.
1. LENGTHS: FABRICATE RECTANGULAR DUCTS IN LENGTHS APPROPRIATE TO REINFORCEMENT AND RIGIDITY CLASS REQUIRED FOR PRESSURE CLASS.
2. DEFLECTION: DUCT SYSTEMS SHALL NOT EXCEED DEFLECTION LIMITS ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE."
B. TRANSVERSE JOINTS: PREFABRICATED SLIDE-ON JOINTS AND COMPONENTS CONSTRUCTED USING MANUFACTURER'S GUIDELINES FOR MATERIAL THICKNESS, REINFORCEMENT SIZE AND SPACING, AND JOINT REINFORCEMENT.
C. FORMED-ON FLANGES: CONSTRUCT ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE," FIGURE 1-4, USING CORNER, BOLT, CLEAT, AND GASKET DETAILS.
1. DUCT SIZE: MAXIMUM 30 INCHES WIDE AND UP TO 2-INCH WG PRESSURE CLASS.
2. LONGITUDINAL SEAMS: PITTSBURGH LOCK SEALED WITH CON-CURING POLYMER SEALANT.
D. CROSS BREAKING OR CROSS BEADING: CROSS BREAK OR CROSS BEAD DUCT SIDES 19 INCHES AND LARGER AND 0.0359 INCH THICK OR LESS, WITH MORE THAN 10 SQ. FT. OF NON-BRACED PANEL AREA UNLESS DUCTS ARE LINED.

2.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION
A. DIAMETER AS APPLIED TO FLAT-OVAL DUCTS IN THIS ARTICLE IS THE DIAMETER OF A ROUND DUCT WITH A CIRCUMFERENCE EQUAL TO THE PERIMETER OF A GIVEN SIZE OF FLAT-OVAL DUCT.
B. ROUND, SPIRAL LOCK-SEAM DUCTS AND FITTINGS: FABRICATE DUCTS AND FITTINGS OF INDICATED MATERIAL ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE." USE OF ADDITIONAL RIBS OR CORRUGATIONS TO ALLOW USAGE OF A LIGHTER GAUGE SHALL NOT BE ACCEPTABLE.
C. FLAT-OVAL, SPIRAL LOCK-SEAM DUCTS AND FITTINGS: FABRICATE DUCTS AND FITTINGS OF INDICATED MATERIAL ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE." FABRICATE DUCTS LARGER THAN 72 INCHES IN DIAMETER WITH BUTT-WELDED LONGITUDINAL SEAMS. USE OF ADDITIONAL RIBS OR CORRUGATIONS TO ALLOW USAGE OF A LIGHTER GAUGE SHALL NOT BE ACCEPTABLE.
D. DUCT JOINTS:
1. DUCTS UP TO 20 INCHES IN DIAMETER: INTERIOR, CENTER-BEADED SLIP COUPLING, SEALED BEFORE AND AFTER FASTENING, ATTACHED WITH SHEET METAL SCREWS.
2. DUCTS 21 TO 72 INCHES IN DIAMETER: THREE-PIECE, GASKETED, FLANGED JOINT CONSISTING OF TWO INTERNAL FLANGES WITH SEALANT AND ONE EXTERNAL CLOSURE BAND WITH GASKET.
3. DUCTS LARGER THAN 72 INCHES IN DIAMETER: COMPANION ANGLE FLANGED JOINTS PER SMACNA "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE," FIGURE 3-2.
4. ROUND DUCTS: PREFABRICATED CONNECTION SYSTEM CONSISTING OF DOUBLE-LIPPED, EPDM RUBBER GASKET. MANUFACTURE DUCTS ACCORDING TO CONNECTION SYSTEM MANUFACTURER'S TOLERANCES.
5. FLAT-OVAL DUCTS: PREFABRICATED CONNECTION SYSTEM CONSISTING OF TWO FLANGES AND ONE SYNTHETIC RUBBER GASKET.
E. FABRICATE ELBOWS USING DIE-FORMED, GORED, PLEATED, OR MITERED CONSTRUCTION. END RADIUS OF DIE-FORMED, GORED, AND PLEATED ELBOWS SHALL BE 1-1/2 TIMES DUCT DIAMETER. UNLESS ELBOW CONSTRUCTION TYPE IS INDICATED, FABRICATE ELBOWS AS FOLLOWS:
1. MITERED-ELBOW RADIUS AND NUMBER OF PIECES: WELDED CONSTRUCTION COMPLYING WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE," UNLESS OTHERWISE INDICATED.
F. LOW PRESSURE ROUND DUCTS SHALL BE FACTORY FABRICATED SPIRAL DUCTS AND FITTINGS OR GROOVED LONGITUDINAL SEAM DUCTS. GROOVED LONGITUDINAL SEAM DUCTS SHALL HAVE SEAMS SEALED WITH MASTIC WHEN FABRICATED AND SECTIONS JOINED WITH BELL AND SPIGOT FITTINGS OR COUPLINGS. FITTINGS AND COUPLINGS SHALL BE SEALED WITH MASTIC TO MAKE AN AIR TIGHT JOINT. FITTINGS FOR SHOP FABRICATED DUCTS MAY BE FORMED OR OF MITERED CONSTRUCTION WITH NOT LESS THAN 3-PIECE 45 DEGREE ELBOWS AND 5-PIECE 90 DEGREE ELBOWS.

PART 3: EXECUTION

3.1 DUCT APPLICATIONS
A. STATIC-PRESSURE CLASSES: UNLESS OTHERWISE INDICATED, SELECT DUCT TYPE, JOINT CONNECTIONS, MATERIALS, AND STATIC-PRESSURE CLASSES ACCORDING TO THE DUCT CONSTRUCTION SCHEDULE ON THE DRAWINGS.
B. ALL DUCTS SHALL BE GALVANIZED STEEL UNLESS OTHERWISE NOTED.

3.2 DUCT INSTALLATION
A. CONSTRUCT AND INSTALL DUCTS ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE," UNLESS OTHERWISE INDICATED. INSTALL DUCTS WITH FEWEST POSSIBLE JOINTS. INSTALL FABRICATED FITTINGS FOR CHANGES IN DIRECTIONS, SIZE, AND SHAPE AND FOR CONNECTIONS.
B. INSTALL DUCTS, UNLESS OTHERWISE INDICATED, VERTICALLY AND HORIZONTALLY AND PARALLEL AND PERPENDICULAR TO BUILDING LINES; AVOID DIAGONAL RUNS.
C. INSTALL DUCTS CLOSE TO WALLS, OVERHEAD CONSTRUCTION, COLUMNS, AND OTHER STRUCTURAL AND PERMANENT ENCLOSURE ELEMENTS OF BUILDING.
D. INSTALL DUCTS WITH A CLEARANCE OF 1 INCH, PLUS ALLOWANCE FOR INSULATION THICKNESS.
E. CONCEAL DUCTS FROM VIEW IN FINISHED SPACES. DO NOT ENCASE HORIZONTAL RUNS IN SOLID PARTITIONS UNLESS SPECIFICALLY INDICATED.
F. COORDINATE LAYOUT WITH SUSPENDED CEILING, FIRE-AND SMOKE-CONTROL DAMPERS, LIGHTING LAYOUTS, AND SIMILAR FINISHED WORK. ROUTE DUCTWORK AT UNDERSIDE OF STRUCTURAL STEEL BEAMS OR BETWEEN STRUCTURAL STEEL BEAMS UNLESS OTHERWISE INDICATED.
G. SEAL ALL JOINTS AND SEAMS. APPLY SEALANT TO MALE END CONNECTORS BEFORE INSERTION, AND AFTERWARD TO COVER ENTIRE JOINT AND SHEET METAL SCREWS.
H. ELECTRICAL EQUIPMENT SPACES: ROUTE DUCTS TO AVOID PASSING THROUGH ELECTRICAL EQUIPMENT SPACES AND ENCLOSURES.
I. NON-FIRE-RATED PARTITION PENETRATIONS: WHERE DUCTS PASS THROUGH INTERIOR PARTITIONS AND EXTERIOR WALLS AND ARE EXPOSED TO VIEW OR CONCEALED, CONCEAL SPACES BETWEEN CONSTRUCTION OPENINGS AND DUCTS OR DUCT INSULATION WITH SHEET METAL FLANGES OF SAME METAL THICKNESS AS DUCTS. OVERLAP OPENINGS ON 4 SIDES BY AT LEAST 1-1/2 INCHES.
J. FIRE-RATED PENETRATIONS: WHERE DUCTS PASS THROUGH RATED WALLS, PARTITIONS, FLOORS OR ROOFS, INSTALL APPROPRIATELY RATED FIRE DAMPERS, SLEEVES, AND FIRESTOPPING SEALANT. FIRE AND SMOKE DAMPERS ARE SPECIFIED IN DIVISION 23 SECTION "DUCT ACCESSORIES."
K. INSTALL DUCTS WITH HANGERS AND BRACES DESIGNED TO WITHSTAND, WITHOUT DAMAGE TO EQUIPMENT, SEISMIC FORCE REQUIRED BY APPLICABLE BUILDING CODES. REFER TO SMACNA'S "SEISMIC RESTRAINT MANUAL: GUIDELINES FOR MECHANICAL SYSTEMS."

3.3 SEAM AND JOINT SEALING
A. SEAL DUCT SEAMS AND JOINTS ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE" FOR DUCT PRESSURE CLASS INDICATED.
1. MEDIUM PRESSURE DUCTWORK ABOVE 2" PRESSURE CLASS: SEAL TO CLASS "A" STANDARDS AS OUTLINED IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE".
a. RECTANGULAR DUCTWORK: SEAL ALL JOINTS AND CONNECTIONS WITH HARD CAST II.
b. ROUND AND FLAT OVAL DUCTWORK: SEAL JOINTS, SEAMS AND CONNECTIONS WITH NON-MIGRATING MASTIC OR LIQUID ELASTIC SEALANT AS RECOMMENDED BY THE MANUFACTURER.
2. LOW PRESSURE DUCTWORK 2-INCH AND LOWER PRESSURE CLASS: SEAL TO CLASS "B" STANDARDS AS OUTLINED IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE".
B. SEAL JOINTS, SEAMS AND CONNECTIONS WITH LIQUID ELASTIC SEALANT AS RECOMMENDED BY THE MANUFACTURER.
C. SEAL DUCTS BEFORE EXTERNAL INSULATION IS APPLIED.

3.4 HANGING AND SUPPORTING
A. DUCTWORK SHALL BE SUPPORTED FROM BUILDING STRUCTURAL STEEL, SUPPLEMENTARY STEEL ANGELES/SUPPORTS, OR CONCRETE FLOOR/ROOF SLABS. DUCTWORK HANGERS/SUPPORTS SHALL NOT BE ATTACHED SOLELY TO METAL DECKING. PROVIDE SUPPLEMENTARY ANGLES/SUPPORTS AS REQUIRED AND PRIOR TO STRUCTURAL STEEL FIREPROOFING.
B. SUPPORT HORIZONTAL DUCTS WITHIN 24 INCHES OF EACH ELBOW AND WITHIN 48 INCHES OF EACH BRANCH INTERSECTION.
C. SUPPORT VERTICAL DUCTS AT MAXIMUM INTERVALS OF 16 FEET AND AT EACH FLOOR.
D. INSTALL UPPER ATTACHMENTS TO STRUCTURES WITH AN ALLOWABLE LOAD NOT EXCEEDING ONE-FOURTH OF FAILURE (PROOF-TEST) LOAD.
E. INSTALL CONCRETE INSERTS BEFORE PLACING CONCRETE.

3.5 CONNECTIONS
A. MAKE CONNECTIONS TO EQUIPMENT WITH FLEXIBLE CONNECTORS ACCORDING TO DIVISION 23 SECTION "DUCT ACCESSORIES."
B. COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE" FOR BRANCH, OUTLET AND INLET, AND TERMINAL UNIT CONNECTIONS.

3.6 DUCT SYSTEM PROTECTION
A. PROTECT DUCT INTERIORS FROM THE ELEMENTS UNTIL BUILDING IS ENCLOSED AND FOREIGN MATERIALS THROUGHOUT THE PROJECT DURATION. FOLLOW SMACNA'S "DUCT CLEANLINESS FOR NEW CONSTRUCTION."
B. PROVIDE FILTERS IN HVAC UNITS AND AT DUCT INLETS TO PROTECT DUCT SYSTEMS FROM DUST IF UNITS ARE PLACED IN OPERATION WHILE CONSTRUCTION IS STILL IN PROGRESS. FILTERS SHALL BE CHANGED REGULARLY TO PREVENT DUST ENTRY INTO DUCTWORK, BUT NO LESS THAN EVERY WEEK.
C. DUCT SYSTEMS THAT HAVE NOT BEEN PROPERLY PROTECTED, AS DETERMINED BY THE ENGINEER, SHALL BE REQUIRED TO BE MECHANICALLY CLEANED USING MECHANICAL AGITATION AND VACUUM-COLLECTION DEVICES.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

MECHANICAL SPECIFICATIONS

SHEET NO.:
M0.03

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1: GENERAL

1.1 SUMMARY

A. THIS SECTION INCLUDES THE FOLLOWING: VOLUME DAMPERS, MOTORIZED CONTROL DAMPERS, FIRE DAMPERS, TURNING VANES, DUCT–MOUNTING ACCESS DOORS, FLEXIBLE CONNECTORS, FLEXIBLE DUCTS, AND DUCT ACCESSORY HARDWARE.

1.2 QUALITY ASSURANCE

A. COMPLY WITH NFPA 90A, "INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS," AND NFPA 90B, "INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS."

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. MANUFACTURERS – VOLUME DAMPERS, MOTORIZED CONTROL DAMPERS, FIRE DAMPERS, SMOKE DAMPERS:
1. CESCO PRODUCTS.
2. GREENHECK.
3. NAILOR INDUSTRIES.
4. NATIONAL CONTROLLED AIR.
5. POTTORFF.
6. PREFCO PRODUCTS, INC.
7. RUSKIN COMPANY.

B. MANUFACTURERS – TURNING VANES:
1. DUCTMATE INDUSTRIES, INC.
2. DURO DYNE CORP.
3. METALAIRE, INC.
4. WARD INDUSTRIES, INC.

C. MANUFACTURERS – DUCT MOUNTED ACCESS DOORS
1. AIR BALANCE (FSA 100 BASIS OF DESIGN).
2. CESCO PRODUCTS.
3. FLEXMASTER U.S.A., INC.
4. GREENHECK.
5. NAILOR INDUSTRIES INC.
6. POTTORFF.
7. VENTFABRICS, INC.

D. MANUFACTURERS – FLEXIBLE CONNECTORS
1. DUCTMATE INDUSTRIES, INC.
2. DURO DYNE CORP.
3. VENTFABRICS, INC.
4. WARD INDUSTRIES, INC.

E. MANUFACTURERS – FLEXIBLE DUCTS
1. FLEXMASTER U.S.A., INC.
2. HART & COOLEY, INC.
3. THERMAFLEX.
4. WIREMOLD.

2.2 SHEET METAL MATERIALS

A. COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS––METAL AND FLEXIBLE" FOR ACCEPTABLE MATERIALS, MATERIAL THICKNESSES, AND DUCT CONSTRUCTION METHODS, UNLESS OTHERWISE INDICATED.
B. GALVANIZED SHEET STEEL: LOCK–FORMING QUALITY; COMPLYING WITH ASTM A 653/A 653M AND HAVING G60 COATING DESIGNATION; DUCTS SHALL HAVE MILL–PHOSPHATIZED FINISH FOR SURFACES EXPOSED TO VIEW.
C. STAINLESS STEEL: ASTM A 480/A 480M.
D. ALUMINUM SHEETS: ASTM B 209, ALLOY 3003, TEMPER H14; WITH MILL FINISH FOR CONCEALED DUCTS AND STANDARD, 1–SIDE BRIGHT FINISH FOR EXPOSED DUCTS.
E. EXTRUDED ALUMINUM: ASTM B 221, ALLOY 6063, TEMPER T6.
F. REINFORCEMENT SHAPES AND PLATES: GALVANIZED–STEEL REINFORCEMENT WHERE INSTALLED ON GALVANIZED SHEET METAL DUCTS; COMPATIBLE MATERIALS FOR ALUMINUM AND STAINLESS–STEEL DUCTS.
G. TIE RODS: GALVANIZED STEEL, 1/4–INCH MINIMUM DIAMETER FOR LENGTHS 36 INCHES OR LESS; 3/8–INCH MINIMUM DIAMETER FOR LENGTHS LONGER THAN 36 INCHES.

2.3 VOLUME DAMPERS

A. GENERAL DESCRIPTION: FACTORY FABRICATED, WITH REQUIRED HARDWARE AND ACCESSORIES. STIFFEN DAMPER BLADES FOR STABILITY. INCLUDE LOCKING DEVICE TO HOLD SINGLE–BLADE DAMPERS IN A FIXED POSITION WITHOUT VIBRATION. CLOSE DUCT PENETRATIONS FOR DAMPER COMPONENTS TO SEAL DUCT CONSISTENT WITH PRESSURE CLASS.
1. PRESSURE CLASSES OF 3–INCH WG OR HIGHER: END BEARINGS OR OTHER SEALS FOR DUCTS WITH AXLES FULL LENGTH OF DAMPER BLADES AND BEARINGS AT BOTH ENDS OF OPERATING SHAFT.

B. STANDARD VOLUME DAMPERS: MULTIPLE–OR SINGLE–BLADE, OPPOSED–BLADE DESIGN, STANDARD LEAKAGE RATING, WITH LINKAGE OUTSIDE AIRSTREAM, AND SUITABLE FOR HORIZONTAL OR VERTICAL APPLICATIONS.
1. STEEL FRAMES: HAT–SHAPED, GALVANIZED SHEET STEEL CHANNELS, MINIMUM OF 0.064 INCH THICK, WITH MITERED AND WELDED CORNERS; FRAMES WITH FLANGES WHERE INDICATED FOR ATTACHING TO WALLS AND FLANGELESS FRAMES WHERE INDICATED FOR INSTALLING IN DUCTS.
2. ROLL–FORMED STEEL BLADES: 0.064–INCH–THICK, GALVANIZED SHEET STEEL, MAXIMUM 10 INCHES WIDE.
3. ALUMINUM FRAMES: HAT–SHAPED, 0.10–INCH– THICK, ALUMINUM SHEET CHANNELS; FRAMES WITH FLANGES WHERE INDICATED FOR ATTACHING TO WALLS; AND FLANGELESS FRAMES WHERE INDICATED FOR INSTALLING IN DUCTS.
4. ROLL–FORMED ALUMINUM BLADES: 0.10–INCH– THICK ALUMINUM SHEET.
5. EXTRUDED–ALUMINUM BLADES: 0.050–INCH– THICK EXTRUDED ALUMINUM.
6. BLADE AXLES: GALVANIZED STEEL.
7. BEARINGS: OIL–IMPREGNATED BRONZE OR MOLDED SYNTHETIC.
8. TIE BARS AND BRACKETS: ALUMINUM.
9. TIE BARS AND BRACKETS: GALVANIZED STEEL.

C. JACKSHAFT: 1–INCH– DIAMETER, GALVANIZED–STEEL PIPE ROTATING WITHIN PIPE–BEARING ASSEMBLY MOUNTED ON SUPPORTS AT EACH MULLION AND AT EACH END OF MULTIPLE–DAMPER ASSEMBLIES.
1. LENGTH AND NUMBER OF MOUNTINGS: APPROPRIATE TO CONNECT LINKAGE OF EACH DAMPER IN MULTIPLE–DAMPER ASSEMBLY.

D. DAMPER HARDWARE: ZINC–PLATED, DIE–CAST CORE WITH DIAL AND HANDLE MADE OF 3/32–INCH– THICK ZINC–PLATED STEEL, AND A 3/4–INCH HEXAGON LOCKING NUT. INCLUDE CENTER HOLE TO SUIT DAMPER OPERATING–ROD SIZE. INCLUDE ELEVATED PLATFORM FOR INSULATED DUCT MOUNTING.

2.4 FIRE DAMPERS

A. FIRE DAMPERS SHALL BE DYNAMIC TYPE UNLESS OTHERWISE INDICATED AND SHALL BE LABELED ACCORDING TO UL 555. FIRE RATING SHALL BE 1–1/2 HOUR FOR FIRE RESISTIVE RATINGS OF 2 HOURS OR LESS; 3 HOURS FOR FIRE RESISTIVE RATINGS OF 3 HOURS OR MORE.
B. FRAME: CURTAIN TYPE WITH BLADES OUTSIDE AIRSTREAM (TYPE B) AND MULTIPLE–BLADE TYPE; FABRICATED WITH ROLL–FORMED, 0.034–INCH – THICK GALVANIZED STEEL; WITH MITERED AND INTERLOCKING CORNERS.
C. MOUNTING SLEEVE: FACTORY– OR FIELD–INSTALLED, GALVANIZED SHEET STEEL.
1. MINIMUM THICKNESS: 0.052 OR 0.138 INCH THICK AS INDICATED AND OF LENGTH TO SUIT APPLICATION.
2. EXCEPTIONS: OMIT SLEEVE WHERE DAMPER FRAME WIDTH PERMITS DIRECT ATTACHMENT OF PERIMETER MOUNTING ANGLES ON EACH SIDE OF WALL OR FLOOR, AND THICKNESS OF DAMPER FRAME COMPLIES WITH SLEEVE REQUIREMENTS.

D. MOUNTING ORIENTATION: VERTICAL OR HORIZONTAL AS INDICATED.
E. BLADES: ROLL–FORMED, INTERLOCKING, 0.034–INCH– THICK, GALVANIZED SHEET STEEL. IN PLACE OF INTERLOCKING BLADES, USE FULL–LENGTH, 0.034–INCH–THICK, GALVANIZED–STEEL BLADE CONNECTORS.
F. HORIZONTAL DAMPERS: INCLUDE BLADE LOCK AND STAINLESS–STEEL CLOSURE SPRING.
G. FUSIBLE LINKS: REPLACEABLE, 165 DEG F RATED.

2.5 TURNING VANES

A. FABRICATE TO COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS––METAL AND FLEXIBLE" FOR VANES AND VANE RUNNERS. VANE RUNNERS SHALL AUTOMATICALLY ALIGN VANES.
B. MANUFACTURED TURNING VANES: FABRICATE 1–1/2–INCH– WIDE, AIRFOIL–VANE, CURVED BLADES OF GALVANIZED SHEET STEEL SET 3/4 INCH O.C.; SUPPORT WITH BARS PERPENDICULAR TO BLADES SET 2 INCHES O.C.; AND SET INTO VANE RUNNERS SUITABLE FOR DUCT MOUNTING.

2.6 DUCT–MOUNTING ACCESS DOOR

A. GENERAL DESCRIPTION: FABRICATE DOORS AIRTIGHT AND SUITABLE FOR DUCT PRESSURE CLASS.
B. DOOR: DOUBLE WALL, DUCT MOUNTING, AND RECTANGULAR; FABRICATED OF GALVANIZED SHEET METAL WITH INSULATION FILL AND THICKNESS AS INDICATED FOR DUCT PRESSURE CLASS (MINIMUM 1–INCH). INCLUDE VISION PANEL WHERE INDICATED. INCLUDE 1–BY–1–INCH BUTT OR PIANO HINGE AND CAM LATCHES.
1. FRAME: GALVANIZED SHEET STEEL, WITH BEND–OVER TABS AND FOAM GASKETS.
2. PROVIDE NUMBER OF HINGES AND LOCKS AS FOLLOWS:
   a. LESS THAN 12 INCHES SQUARE: SECURE WITH TWO SASH LOCKS.
   b. UP TO 18 INCHES SQUARE: TWO HINGES AND TWO SASH LOCKS.
   c. UP TO 24 BY 48 INCHES: THREE HINGES AND TWO COMPRESSION LATCHES WITH OUTSIDE AND INSIDE HANDLES.
   d. SIZES 24 BY 48 INCHES AND LARGER: ONE ADDITIONAL HINGE.

C. DOOR: DOUBLE WALL, DUCT MOUNTING, AND ROUND; FABRICATED OF GALVANIZED SHEET METAL WITH INSULATION FILL AND 1–INCH THICKNESS. INCLUDE CAM LATCHES.
1. FRAME: GALVANIZED SHEET STEEL, WITH SPIN–IN NOTCHED FRAME.

D. SEAL AROUND FRAME ATTACHMENT TO DUCT AND DOOR TO FRAME WITH NEOPRENE OR FOAM RUBBER.
E. INSULATION: 1–INCH– THICK, FIBROUS–GLASS OR POLYSTYRENE–FOAM BOARD.

2.7 FLEXIBLE CONNECTORS

A. GENERAL DESCRIPTION: FLAME–RETARDANT OR NONCOMBUSTIBLE FABRICS, COATINGS, AND ADHESIVES COMPLYING WITH UL 181, CLASS 1.
B. METAL–EDGED CONNECTORS: FACTORY FABRICATED WITH A FABRIC STRIP ALUMINUM SHEETS. SELECT METAL COMPATIBLE WITH DUCTS. CONNECTOR FABRIC IN PARAGRAPH BELOW IS NOT SUITABLE FOR EXPOSURE TO SUN, WEATHER, OR CORROSIVE ENVIRONMENTS. IT IS SUITABLE FOR SYSTEM TEMPERATURES FROM MINUS 10 TO PLUS 200 DEG F (MINUS 23 TO PLUS 93 DEG C).
C. INDOOR SYSTEM, FLEXIBLE CONNECTOR FABRIC: GLASS FABRIC DOUBLE COATED WITH NEOPRENE.
1. MINIMUM WEIGHT: 29 OZ./SQ. YD.
2. SERVICE TEMPERATURE: MINUS 20 TO PLUS 200 DEG F.

D. OUTDOOR SYSTEM, FLEXIBLE CONNECTOR FABRIC: GLASS FABRIC DOUBLE COATED WITH WEATHERPROOF, SYNTHETIC RUBBER RESISTANT TO UV RAYS AND OZONE.
1. MINIMUM WEIGHT: 24 OZ./SQ. YD.
2. TENSILE STRENGTH: 530 LBF/INCH IN THE WARP AND 440 LBF/INCH IN THE FILLING.
3. SERVICE TEMPERATURE: MINUS 10 TO PLUS 250 DEG F.

2.8 FLEXIBLE DUCTS

A. INSULATED–DUCT CONNECTORS: UL 181, CLASS 1, VINYL IMPREGNATED AND COATED FIBER GLASS MESH INNER SLEEVE SUPPORTED BY HELICALLY WOUND, VINYL COATED SPRING–STEEL WIRE; 1–INCH THICK FIBROUS–GLASS INSULATION; OUTER FOIL BACKED KRAFT PAPER VAPOR BARRIER.
1. PRESSURE RATING: 6–INCH WG POSITIVE AND 1.0–INCH WG NEGATIVE.
2. MAXIMUM AIR VELOCITY: 4000 FPM.
3. TEMPERATURE RANGE: MINUS 20 TO PLUS 250 DEG F.

B. FLEXIBLE DUCT CLAMPS: STAINLESS–STEEL BAND WITH CADMIUM–PLATED HEX SCREW TO TIGHTEN BAND WITH A WORM–GEAR ACTION, IN SIZES 3 THROUGH 18 INCHES TO SUIT DUCT SIZE.

2.9 DUCT ACCESSORY HARDWARE

A. INSTRUMENT TEST HOLES: CAST IRON OR CAST ALUMINUM TO SUIT DUCT MATERIAL, INCLUDING SCREW CAP AND GASKET. SIZE TO ALLOW INSERTION OF PITOT TUBE AND OTHER TESTING INSTRUMENTS AND OF LENGTH TO SUIT DUCT INSULATION THICKNESS.
B. ADHESIVES: HIGH STRENGTH, QUICK SETTING, NEOPRENE BASED, WATERPROOF, AND RESISTANT TO GASOLINE AND GREASE.

PART 3: EXECUTION

3.1 APPLICATION AND INSTALLATION

A. INSTALL DUCT ACCESSORIES ACCORDING TO APPLICABLE DETAILS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS––METAL AND FLEXIBLE" FOR METAL DUCTS.
B. PROVIDE DUCT ACCESSORIES OF MATERIALS SUITED TO DUCT MATERIALS; USE GALVANIZED–STEEL ACCESSORIES IN GALVANIZED–STEEL DUCTS, STAINLESS–STEEL ACCESSORIES IN STAINLESS–STEEL DUCTS, AND ALUMINUM ACCESSORIES IN ALUMINUM DUCTS.
C. PROVIDE BALANCING DAMPERS AT POINTS ON SUPPLY, RETURN, AND EXHAUST SYSTEMS WHERE BRANCHES LEAD FROM LARGER DUCTS AS REQUIRED FOR AIR BALANCING. INSTALL AT A MINIMUM OF TWO DUCT WIDTHS FROM BRANCH TAKEOFF.
D. PROVIDE TEST HOLES AT FAN INLETS AND OUTLETS AND ELSEWHERE AS INDICATED.
E. INSTALL FIRE AND SMOKE DAMPERS, WITH FUSIBLE LINKS, ACCORDING TO MANUFACTURER'S UL–APPROVED WRITTEN INSTRUCTIONS. PROVIDE FIRE DAMPERS AS FOLLOWS:
1. FLOOR AND ROOF PENETRATIONS: MULTIPLE BLADE TYPE.
2. WALL PENETRATIONS: CURTAIN TYPE OR MULTIPLE BLADE TYPE.

F. INSTALL DUCT ACCESS DOORS TO ALLOW FOR INSPECTING, ADJUSTING, AND MAINTAINING ACCESSORIES AND TERMINAL UNITS AS FOLLOWS:
1. ON BOTH SIDES OF DUCT COILS.
2. DOWNSTREAM FROM EQUIPMENT.
3. ADJACENT TO FIRE AND SMOKE DAMPERS, PROVIDING ACCESS TO RESET OR REINSTALL FUSIBLE LINKS.
4. ON SIDES OF DUCTS WHERE ADEQUATE CLEARANCE IS AVAILABLE.

G. INSTALL THE FOLLOWING SIZES FOR DUCT–MOUNTING, RECTANGULAR ACCESS DOORS:
1. ONE–HAND OR INSPECTION ACCESS: 8 BY 5 INCHES.
2. TWO–HAND ACCESS: 12 BY 6 INCHES.
3. HEAD AND HAND ACCESS: 18 BY 10 INCHES.
4. HEAD AND SHOULDERS ACCESS: 21 BY 14 INCHES.
5. BODY ACCESS: 25 BY 14 INCHES.
6. BODY PLUS LADDER ACCESS: 25 BY 17 INCHES.

H. INSTALL THE FOLLOWING SIZES FOR DUCT–MOUNTING, ROUND ACCESS DOORS:
1. ONE–HAND OR INSPECTION ACCESS: 8 INCHES IN DIAMETER.
2. TWO–HAND ACCESS: 10 INCHES IN DIAMETER.
3. HEAD AND HAND ACCESS: 12 INCHES IN DIAMETER.
4. HEAD AND SHOULDERS ACCESS: 18 INCHES IN DIAMETER.
5. BODY ACCESS: 24 INCHES IN DIAMETER.

I. LABEL ACCESS DOORS ACCORDING TO DIVISION 23 SECTION "MECHANICAL IDENTIFICATION."
J. INSTALL FLEXIBLE CONNECTORS IMMEDIATELY ADJACENT TO EQUIPMENT IN DUCTS ASSOCIATED WITH FANS AND MOTORIZED EQUIPMENT SUPPORTED BY VIBRATION ISOLATORS. FOR FANS DEVELOPING STATIC PRESSURES OF 5–INCH WG AND HIGHER, COVER FLEXIBLE CONNECTORS WITH LOADED VINYL SHEET HELD IN PLACE WITH METAL STRAPS.
K. CONNECT TERMINAL UNITS TO SUPPLY DUCTS DIRECTLY.
L. CONNECT DIFFUSERS OR GRILLES TO LOW PRESSURE DUCTS DIRECTLY. MAXIMUM 60–INCH LENGTHS OF STRAIGHT FLEXIBLE DUCT CAN BE USED FOR STRAIGHT RUNS. DO NOT USE FLEXIBLE DUCTS TO CHANGE DIRECTIONS. CONNECT FLEXIBLE DUCTS TO METAL DUCTS WITH DRAW BANDS. PROVIDE HARD ELBOW AT DIFFUSERS.

3.2 ADJUSTING

A. ADJUST DUCT ACCESSORIES FOR PROPER SETTINGS.
B. ADJUST FIRE AND SMOKE DAMPERS FOR PROPER ACTION.
C. FINAL POSITIONING OF MANUAL–VOLUME DAMPERS IS SPECIFIED IN DIVISION 23 SECTION "TESTING, ADJUSTING, AND BALANCING."

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

MECHANICAL SPECIFICATIONS

SHEET NO.: M0.04

DUCT CONSTRUCTION SCHEDULE

SERVICE	LOCATION	DUCT TYPE/ MATERIAL	SINGLE WALL/ DOUBLE WALL	PRESSURE CLASSIFICATION	SMACNA SEAL CLASS.	SMACNA LEAKAGE CLASS.		APPLICABLE CODE/STANDARD
						RECTANGULAR	ROUND	
SUPPLY / OUTSIDE AIR	CONCEALED ABOVE CEILINGS OR IN CHASES, OR LOCATED IN MECHANICAL ROOMS	GALVANIZED STEEL, RECTANGULAR W/ FLANGED OR SLIP & DRIVE JOINTS, SPIRAL, OR GROOVED LONG. SEAM	SINGLE	2"	B	12	6	NOTES 1, 2, 3, 4
EXHAUST	CONCEALED ABOVE CEILINGS OR IN CHASES, OR LOCATED IN MECHANICAL ROOMS	GALV. STEEL, RECTANGULAR W/ FLANGED OR SLIP & DRIVE JOINTS, SPIRAL, OR GROOVED LONG. SEAM	SINGLE	2"	B	12	6	NOTES 1, 2, 3, 4

NOTES:
1. SMACNA HVAC DUCT CONSTRUCTION STANDARDS – METAL AND FLEXIBLE.
2. NFPA 90A, INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS.
3. INTERNATIONAL MECHANICAL CODE.
4. LISTED CODES AND STANDARDS SHALL BE CURRENT ADOPTED EDITION.
5. NFPA 96, VENTILATION CONTROL AND FIRE PROTECTION OF COMMERCIAL COOKING OPERATIONS.
6. PROVIDE GIRTH RINGS ON 5 FOOT CENTERS.

HVAC EQUIPMENT

MARK	DESCRIPTION	SUPPLY (CFM)	RETURN (CFM)	OUTSIDE AIR (CFM)	TOTAL CLG (MBH)	SENS CLG (MBH)	COND. AMB AIR (°F DB)	COOLING INPUT (W)	HEATING OUTPUT (MBH)	POWER SUPPLY	FAN HP	MINIMUM CIRCUIT AMP	MODEL
DSS–I	EVAPORATOR	300	–	–	9	–	–	890	–	208V/1ø/60	–	3.15 A	TRANE 4MXW6509A10N0BA
DSS–O	HEAT PUMP	–	–	–	–	–	95	–	9	208V/1ø/60	–	10 MCA, 15 MOP	TRANE 4TXK6509A10N0BA

SPLIT SYSTEMS NOTES:
1. PROVIDE OUTDOOR UNITS WITH ANTI–SHORT–CYCLE TIMERS.
2. UNITS SHALL BE MATCHED SPLIT SYSTEM HEAT PUMPS.
3. PROVIDE THERMAL EXPANSION VALVE WITH INDOOR UNITS. PROVIDE FILTER DRYER WITH OUTDOOR UNITS.
4. SPLIT SYSTEMS SHALL HAVE 7 DAY PROGRAMMABLE HEATING/COOLING THERMOSTATS. THERMOSTATS SHALL BE MINIMUM 2 STAGE HEATING/1 STAGE COOLING THERMOSTATS.
5. DRAIN EVAPORATOR OUT TO GRADE WITH SPLASH BLOCK.

DUCTLESS SPLIT SYSTEMS NOTES:
1. ACCEPTABLE MANUFACTURERS ARE TRANE, MITSUBISHI AND SANYO. SELECTIONS BASED ON TRANE.

FAN SCHEDULE

MARK	DESCRIPTION	TYPE	HP	POWER SUPPLY	ESP (IN. WC)	CFM	MAX FAN RPM	MAX SONES	MIN FAN DIA. (IN.)	DRIVE ARRANGEMENT	ACCESSORIES								MODEL	NOTES	CONTROL
											A	B	C	D	E	F	G	H			
EF–1	BATHROOM	CEILING EXHAUST FAN	–	115V/1ø/60	.25	200	900	2	–	BELT DRIVE			X	X	X				SP–A200	1, 2	OCCUPANCY
SF–1	BATHROOM	INLINE CABINET FAN	–	115V/1ø/60	.25	200	900	2	–	BELT DRIVE			X	X	X				CSP–A200	1, 3	OCCUPANCY

NOTES:
1. ACCEPTABLE MANUFACTURERS ARE ACME, GREENHECK, AND LOREN COOK. SELECTIONS BASED ON ACME.
2. SURFACE MOUNT.
3. MOUNT ABOVE HARD CEILING IN BETWEEN JOISTS.

ACCESSORIES:
A. 120V MOTOR OPERATED DAMPER
B. ROOF CURB, 18–INCH HIGH U.O.N.
C. SPEED CONTROLLER
D. DISCONNECT SWITCH
E. MOTOR OVERLOADS FOR 115V/1ø FAN MOTORS
F. CURB ADAPTER
G. MOTOR RATED FOR VARIABLE FREQUENCY DRIVE SERVICE
H. WALL CAP

REGISTER, GRILLE, AND DIFFUSER SCHEDULE

MARK	CFM	P.D. (IN. W.G.)	RUNOUT SIZE (DIA. INCHES)	NECK SIZE (INCHES)	AIR PATTERN	PANEL SIZE (INCHES)	TYPE	MATERIAL	FINISH	ACCESSORIES								MODEL		NOTES
										A	B	C	D	E	F	G	H	T&B	PRICE	
A	180–280	0.06	AS INDICATED	12 x 12	SEE PLANS	–	SURFACE MT. SUPPLY	ALUMINUM	WHITE									AM	AMD	1, 2

GENERAL NOTES:
1. SELECTIONS BASED ON PRICE AND TUTTLE & BAILEY.
2. MAXIMUM 30 NC RATING.

ACCESSORIES:
A. OPPOSED BLADE DAMPERS (SQUARE/RECT NECK)
B. RADIAL DAMPER (ROUND NECK)
C. SQUARE TO ROUND ADAPTERS (AS REQUIRED)
D. DOUBLE DEFLECTION WITH ADJUSTABLE VANES.
E. ADJUSTABLE AIR PATTERN VANES.
F. PLASTER FRAME.
G. PROVIDE DIFFUSER WITH MULTI–ORIFICED JET INDUCTION AND AIR MIXING DIFFUSING VANES.

PIPING APPLICATION CHART

DESCRIPTION				PIPING APPLICATION						FITTING APPLICATION		
LINE	SYSTEM	PIPE SIZE	PRESSURE RANGE	MATERIAL	ASTM STANDARD	MFG. PROCESS	WEIGHT	JOINT	PRESSURE RATING (PSIG)	MATERIAL	CLASS	JOINT
1	REFRIGERANT LIQUID & SUCTION PIPING	NPS 2" AND SMALLER	–	WROUGHT COPPER	B 280	DRAWN	ACR	BRAZED	350	WROUGHT COPPER	–	BRAZED
2	COOLING COIL CONDENSATE DRAIN PIPING	NPS 2" AND SMALLER	–	COPPER	B 88	DRAWN	TYPE L	95–5 LEAD FREE SOLDER	350	WROUGHT COPPER	–	95–5 LEAD FREE SOLDER

NOTES:

DUCT INSULATION SCHEDULE

SERVICE	INSULATION TYPE	FINISH/JACKET	INSULATION THICKNESS (IN.)	INSUL. DENSITY (LB./CF)
EXHAUST, SUPPLY AND OUTSIDE AIR	FIBERGLASS BLANKET	FSK	2.2	0.75

NOTES:
1. PROVIDE CONTINUOUS VAPOR BARRIER ON ALL DUCTWORK.
2. FIBERGLASS DUCT LINER SHALL CONTAIN AN ANTI–MICROBIAL AGENT TO RESIST BACTERIAL AND FUNGAL GROWTH.
3. FINISH/JACKET LEGEND: FOIL/SCRIM/KRAFT JACKET (FSK), CANVAS JACKET (CJ), INSULATION CEMENT (IC), ALUMINUM JACKET (AJ), ALUMINUM JACKET, STUCCO EMBOSSED (AJ–SE), WATERPROOF MASTIC (WM).

RADIANT CEILING PANEL SCHEDULE

MARK	WATT RATING	VOLT/PH/HZ	PANEL SIZE (IN.)	MODEL NO.	NOTES
RCP–1	750	120/1/60	24 x 48	CP127	1, 2, 3, 4, 5

NOTES:
1. ACCEPTABLE MANUFACTURERS ARE Q–MARK. MODEL NUMBERS BASED ON Q–MARK.
2. PROVIDE WITH BACNET CAPABLE THERMOSTAT AND METAL LOCKABLE COVER.
3. LINE VOLTAGE THERMOSTAT WIRING BY ELECTRICAL CONTRACTOR.
4. DISCONNECT SWITCHES FOR RADIANT HEATERS BY ELECTRICAL CONTRACTOR.
5. CONTROLS, LOW VOLTAGE WIRING, AND COMMUNICATION WITH HVAC CONTROL SYSTEM BY CONTROLS CONTRACTOR.

LOUVER SCHEDULE

MARK	LOCATION	SIZE (IN.) (W X H)	MIN FREE AREA (SF)	CFM	MODEL NUMBER	MANUFACTURER	NOTES
L–1	SEE PLANS	45 x 61	10.2	–	ESJ–401	GREENHECK	1,2,3
1 L–2	SEE PLANS	45 x 12	1.34	–	ESJ–401	GREENHECK	1,2,3

NOTES:
1. ACCEPTABLE MANUFACTURERS ARE GREENHECK, CESCO, AND RUSKIN. SELECTIONS BASED ON GREENHECK.
2. LOUVER COLOR AND FINISH SELECTION BY OWNER.
3. VERIFY SIZE WITH CURRENT OPENINGS.

PIPE INSULATION SCHEDULE

SERVICE	INSULATION TYPE	FINISH / JACKET		PIPE SIZE		
		INDOOR	OUTDOOR	3/4" & LESS	1" TO 1–1/4"	1–1/2"
REFRIGERANT SUCTION PIPING AND CONDENSATE DRAIN PIPING	FLEXIBLE ELASTOMERIC	–	UPC	1/2"	1/2"	1"

NOTES:
1. ALL PIPING SYSTEMS 2 1/2" AND ABOVE SHALL HAVE CALCIUM SILICATE INSERTS AT HANGERS.
2. PROTECT INDIRECT HUNG PIPING WITH GALVANIZED INSULATION PROTECTION SHIELDS FOR TEMPERATURES 180°F AND BELOW.
3. ALL PIPING SHALL HAVE INSULATION CONTINUOUS THROUGH HANGERS.
4. TIGHTEN ALL HANGER NUTS AFTER INSTALLATION OF INSULATION THROUGH HANGERS.
5. FINISH / JACKET LEGEND: ALL SERVICE JACKET WITH SELF–SEALING LAB (ASJ–SSL), ALUMINUM JACKET–STUCCO EMBOSSED (AJ–SE), ULTRAVIOLET PROTECTIVE COATING (UPC).

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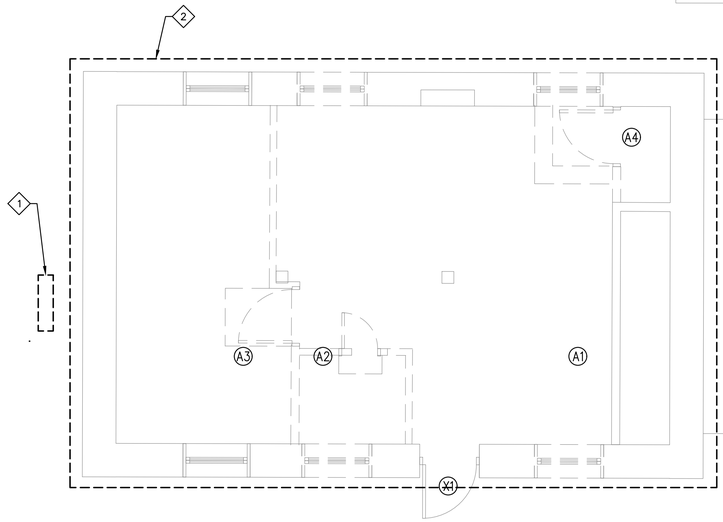
CONSTRUCTION DOCUMENTS

REVISIONS:
1 BID ALTERNATE # 1

DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: N/A

MECHANICAL SCHEDULES

SHEET NO.:
M0.05



MECHANICAL DEMOLITION PLAN
SCALE: 1/4" = 1'-0"

◇ DEMOLITION NOTES

1. REMOVE EXISTING DUCTLESS SPLIT SYSTEM AND ALL ASSOCIATED EQUIPMENT, HARDWARE, PIPING, WIRING ETC.
2. DEMOLISH ALL MECHANICAL EQUIPMENT AND PIPING WITHIN AND ABOVE PROJECT BOUNDARY.

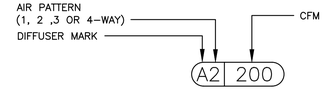
□ CONSTRUCTION NOTES

1. WEATHER SEAL WITH EXTERIOR GRADE CAULKING ASSEMBLY OF LOUVER, PLENUM AND BLOCKING. CAULKING COLOR BY OWNER.
2. LOCATE JOISTS AND POSITION DUCT CENTERED IN BETWEEN JOISTS IN ORDER TO ALLOW STRAIGHT RUN AND ENSURE FAN WILL FIT WITHIN JOIST SPACE.
3. BLOCKING BEHIND LOUVER AND UNDERNEATH PLENUM SHALL ENCOMPASS ENTIRE REMAINING WIDTH OF MASONRY WALL. THE BLOCKING SHALL BE CONSTRUCTED METAL PLATE LINER, WOOD FRAMING, R-13 INSULATION, AND DRY WALL.
4. GRILLS AND DIFFUSERS ARE TO BE SURFACE MOUNTED ON HARD CEILING AND WILL BE AT PROPER CEILING HEIGHT. THEY SHALL HAVE FLEX CONNECTIONS.
5. MINI DUCTLESS SPLIT SYSTEM INSTALLED PER MANUFACTURERS MANUAL. OUTDOOR UNIT PLACED ON EXTERIOR WALL AND INDOOR UNIT HUNG ON INTERIOR WALL.
6. REDUCE DUCT PROTRUSION AS MUCH AS POSSIBLE AND PROTECT ACCORDINGLY.
7. WELDED SEEM DUCT CONNECTION TO PLENUM IS NEEDED. SEE DETAIL VIEW ON THIS SHEET.
8. RAISE DUCT AS CLOSE TO INTERIOR BRICK AS POSSIBLE CONSIDERING THE PRESENCE OF APPROPRIATE INSULATION AND WEATHER SEALING.

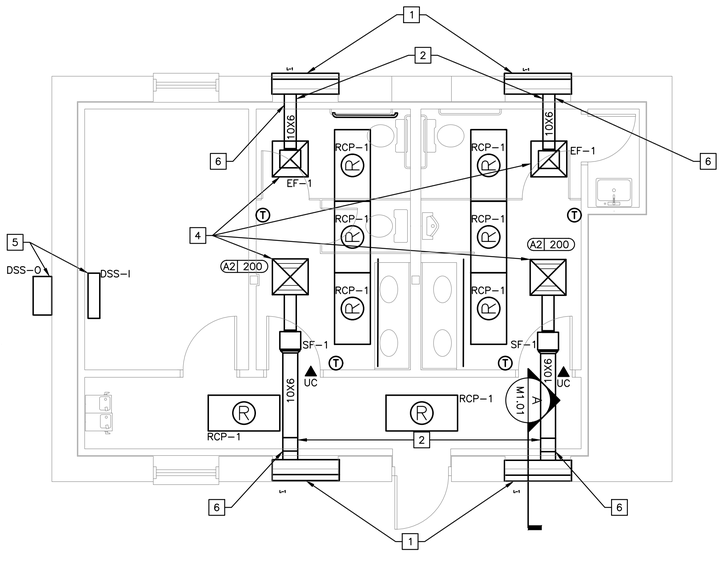
GENERAL NOTES

1. DEMOLITION INCLUDES REMOVAL OF ALL PIPING SERVING FLOORS ABOVE. CAP ALL REMAINING PIPING IN FLOOR ABOVE.
2. FIELD VERIFY BRICK WINDOW OPENING DIMENSIONS POST DEMOLITION. COORDINATE WITH MASONRY TO CREATE A SQUARED OPENING OF TYPICAL DIMENSION. CONTRACTOR SHALL THEN SIZE CUSTOM LOUVER AND PLENUM PER DIMENSION.

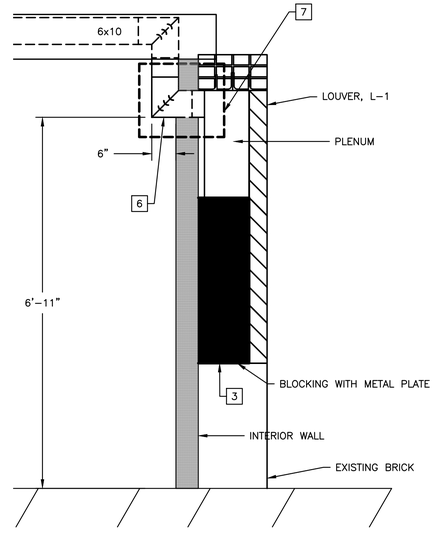
SUPPLY DIFFUSER KEY



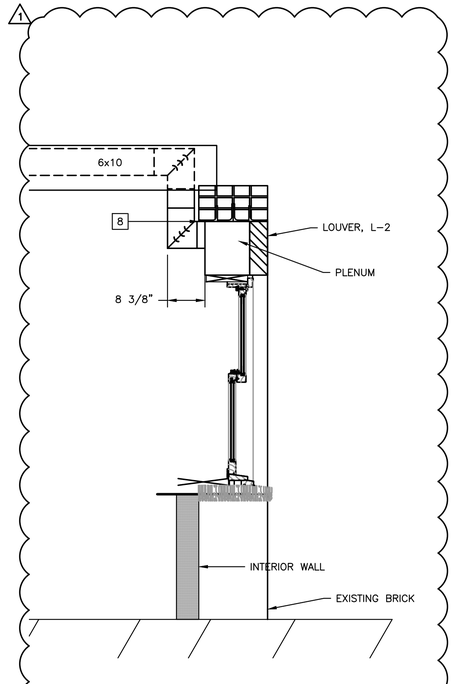
NOTE: SEE DIFFUSERS ON PLAN FOR DIRECTION OF AIR PATTERN



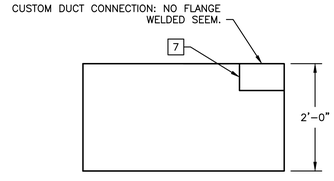
MECHANICAL PLAN
SCALE: 1/4" = 1'-0"



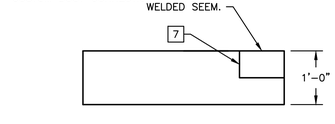
SECTION VIEW A (TYP 4)
SCALE: 3/4" = 1'-0"



BID ALTERNATE #1 (TYP 4)
SCALE: 3/4" = 1'-0"



DETAIL VIEW
SCALE: 3/4" = 1'-0"



BID ALTERNATE # 1
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CONSTRUCTION DOCUMENTS

REVISIONS:
1 BID ALTERNATE # 1

DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: 1/4" = 1'-0"

MECHANICAL PLAN

SHEET NO.:
M1.01

PLUMBING LEGEND

ALL SYMBOLS INDICATED MAY NOT APPEAR ON THESE CONTRACT DRAWINGS

DOMESTIC COLD WATER SUPPLY	AUTOFLOW CONTROL VALVE
DOMESTIC HOT WATER SUPPLY	FLOW METER
DOMESTIC HOT WATER RECIRCULATING	CIRCUIT SENSOR
SAN — SANITARY WASTE	MANUAL AIR VENT
SANITARY WASTE VENT	AUTOMATIC AIR VENT
SW — SOFTENED WATER	PRESSURE GAUGE WITH GAUGE COCK
ST — STORM DRAIN	SIPHON
G — GAS, NATURAL PROPANE	PRESSURE\TEMPERATURE TEST PORT
FP — SPRINKLER PIPING	HOSE END DRAIN
ACID — PVDF ACID WASTE PIPING	STRAINER
A — COMPRESSED AIR	STRAINER WITH BLOW DOWN
PITCH DOWN IN DIRECTION OF ARROW	THERMOMETER
DIRECTION OF FLOW	SILL COCK
PIPE TURNING DOWN	HOSE BIBB
PIPE TURNING UP	WALL HYDRANT
RISER UP OR DOWN	FLOOR DRAIN
TEE AND ELBOW UP	ROOF DRAIN
TEE AND ELBOW DOWN	FLOOR CLEANOUT
TEE UP	HORIZONTAL CLEANOUT ON MAIN
UNION	WALL CLEANOUT
FLANGE	P-TRAP
PIPE CAP	PUMP
PIPE CONCENTRIC REDUCER/INCREASER	VENT THRU ROOF
PIPE ECCENTRIC REDUCER/INCREASER	WATER HAMMER ARRESTOR, P.D.I. SIZE INDICATED
BUTTERFLY VALVE	TRAP PRIMER WITH BALL VALVE
BALL VALVE	PRESSURE SWITCH
GATE VALVE	FLOW SWITCH
PLUG VALVE	HOSE STATION
GLOBE VALVE	CONNECTION POINT
NEEDLE VALVE	DEMOLITION POINT
GAS COCK	CONSTRUCTION NOTE
PRESSURE REDUCING VALVE	DEMOLITION NOTE
PRESSURE RELIEF/SAFETY VALVE	ROOM NUMBER
TWO WAY CONTROL VALVE	RISER NO / SHEET NO WHERE RISER SHOWN — SANITARY (WASTE) RISER
THREE WAY CONTROL VALVE	
SOLENOID VALVE	RISER NO / SHEET NO WHERE RISER SHOWN — WATER RISER
FLEX CONNECTOR	
SWING GATE CHECK VALVE	< > FLOW RATE IN GPM U.N.O.
SPRING CHECK VALVE	(B) INDICATES PIPING INSTALLED IN BEAM SPACE
BACKFLOW PREVENTER	
CIRCUIT SETTER	

GENERAL BID NOTE

1. EXISTING PLUMBING IS BASED ON ORIGINAL CONSTRUCTION DRAWINGS AND MAY NOT REFLECT CURRENT PLUMBING/FIXTURES LAYOUT. CONTRACTOR SHALL FIELD VERIFY ACTUAL CONDITIONS PRIOR TO PRICING AND BEFORE PROCEEDING WITH WORK. NOTIFY ENGINEER IN THE EVENT THAT EXISTING PLUMBING SHOWN TO REMAIN IS SIGNIFICANTLY DIFFERENT FROM EXISTING CONDITIONS.
2. CONTRACTORS SHALL BE RESPONSIBLE FOR MATCHING EXISTING BUILDING SYSTEMS WHERE REQUIRED BY DEMOLITION AND NEW WORK. ITEMS INCLUDING BUT NOT LIMITED TO: WALL TYPES, INSULATION, GLASS, CONCRETE, REBAR, ETC. SHALL MATCH EXISTING DESIGN CONDITIONS WHEN REPLACED OR REPAIRED.

PLUMBING SUBMITTAL NOTES

1. GENERAL: THE CONTRACTOR SHALL SUBMIT INFORMATION TO THE OWNER DEMONSTRATING COMPLIANCE OF PRODUCTS AND INSTALLATION OF DRAWINGS AND SPECIFICATIONS. THIS INFORMATION SHALL INCLUDE BUT NOT BE LIMITED TO: CATALOG DATA, PERFORMANCE DATA, FAN CURVES, PUMP CURVES, ELECTRICAL REQUIREMENTS INCLUDING OVER CURRENT PROTECTION DATA, PRODUCT DIMENSIONS, SPECIAL INSTALLATION REQUIREMENTS AND RECOMMENDED CLEARANCES.
2. RESUBMISSION: CONTRACTOR SHALL CHANGE OR CORRECT SUBMITTALS AS REQUIRED BY THE OWNER AND RESUBMIT UNTIL APPROVED. THE CONTRACTOR SHALL ALSO INDICATE ANY CHANGES WHICH HAVE BEEN MADE OTHER THAN THOSE REQUESTED BY THE OWNER OR ENGINEER.

PLUMBING ABBREVIATIONS

ALL ABBREVIATIONS INDICATED MAY NOT APPEAR ON THESE CONTRACT DRAWINGS

@	AT	KW	KILOWATTS
A	AMPERE	LC	LIGHTING CONTACTOR
A/C	AIR CONDITIONING	LWT	LEAVING WATER TEMPERATURE
ABV	ABOVE	MACH	MACHINE
AFC	ABOVE FINISHED CEILING	MAX.	MAXIMUM
AFF	ABOVE FINISHED FLOOR	MC	MECHANICAL CONTRACTOR
AFG	ABOVE FINISHED GRADE	MFR	MANUFACTURER
AL	ALUMINUM	MIN	MINIMUM
ALT	ALTERNATE	NC	NORMALLY CLOSED
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	NIC	NOT IN CONTRACT
APPROX	APPROXIMATE	NO	NORMALLY OPEN
AVG	AVERAGE	NOM.	NOMINAL
ARF	ABOVE RAISED FLOOR	NPS	NOMINAL PIPE SIZE
BAS	BUILDING AUTOMATION SYSTEM	NTS	NOT TO SCALE
BEL	BELOW	OEM	ORIGINAL EQUIPMENT MANUFACTURER
BFF	BELOW FINISHED FLOOR	ORD	OVERFLOW ROOF DRAIN
BFC	BELOW FINISHED CEILING	P-1	PLUMBING FIXTURE DESIGNATION
BKBD	BACKBOARD	P	PUMP
BLDG	BUILDING	PC	PUMPED CONDENSATE
BOM	BILL OF MATERIALS	PD	PRESSURE DROP
BRF	BELOW RAISED FLOOR	P.D.I.	PLUMBING AND DRAINAGE INSTITUTE
CLG	CEILING	PRV	PRESSURE REDUCING VALVE
CO	CLEANOUT	PSI	POUNDS PER SQUARE INCH
DEMO	DEMOLITION	RD	ROOF DRAIN
DHWRP-1	DOMESTIC HOT WATER RECIRCULATING PUMP	RL	RAIN LEADER
DIA	DIAMETER	REFRIG	REFRIGERATOR
DIAG	DIAGRAM	REQ	REQUIRED
DN	DOWN	SS	STAINLESS STEEL
DWG	DRAWING	SAN	SANITARY WASTE
DWRP-1	DOMESTIC WATER RECIRCULATING PUMP	SC	SILL COCK
ELEV	ELEVATION OR ELEVATOR	SF.	SQUARE FEET
EQUIP	EQUIPMENT	SPEC	SPECIFICATION
ER	EXISTING RELOCATED	ST	STORM DRAIN
ETR	EXISTING TO REMAIN	STD	STANDARD
EWC	ELECTRIC WATER COOLER	SW	SOFTENED WATER
EWH	ELECTRIC WATER HEATER	TD	TRENCH DRAIN
EWT	ENTERING WATER TEMPERATURE	TEMP	TEMPERATURE
EX	EXISTING	TOF	TOP OF FOOTER
FBO	FURNISHED BY OTHERS	TRANSF	TRANSFER
FC	FLEXIBLE CONNECTION	TYP	TYPICAL
FD	FLOOR DRAIN	UC	UNDERCOUNTER
FDC	FIRE DEPARTMENT CONNECTION	UL	UNDERWRITERS LABORATORY
FFE	FINISH FLOOR ELEVATION	U.N.O.	UNLESS NOTED OTHERWISE
FL	FLANGES	V	VALVE
FLEX	FLEXIBLE	VERT	VERTICAL
FLR	FLOOR	VFD	VARIABLE FREQUENCY DRIVE
GC	GENERAL CONTRACTOR	VTR	VENT TO ROOF
GPH	GALLONS PER HOUR	W/	WITH/
GPM	GALLONS PER MINUTE	W/O	WITH OUT
GWB	GYPSUM WALL BOARD	WCO	WALL CLEANOUT
GWH	GAS WATER HEATER	WF	WATER FILTER
HB	HOSE BIBB	WFMD	WATER FLOW MEASURING DEVICE
HORZ	HORIZONTAL	WH	WALL HYDRANT
HP	HORSEPOWER	WHA	WATER HAMMER ARRESTOR
HT	HEIGHT	WP	WEATHER PROOF
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING	WTR	WATER
I.E.	INVERT ELEVATION	WWM	WELDED WIRE MESH

PLUMBING GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REGULATIONS OF APPLICABLE FEDERAL, STATE, LOCAL LAWS, ORDINANCES AND CODES. PLUMBING WORK SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF THE INTERNATIONAL PLUMBING CODE AND ANY APPROVED SUPPLEMENTS TO THAT CODE.
2. THE DRAWINGS ILLUSTRATE GENERAL SCOPE AND ARRANGEMENT OF PLUMBING SYSTEMS. THEY SHALL BE FOLLOWED AS CLOSELY AS ACTUAL CONDITIONS ALLOW. PLUMBING CONTRACTOR SHALL PROVIDE FITTINGS AND OFFSETS IN PIPING TO AVOID FIELD INTERFERENCES.
3. ELECTRICAL DATA ILLUSTRATED IS THAT PUBLISHED BY THE MANUFACTURER.
4. NOT ALL SPECIFICATIONS WILL BE APPLICABLE TO THIS PROJECT. USE SPECIFICATION SECTIONS AND SUB-SECTIONS AS THEY APPLY TO THE PLUMBING SYSTEMS BEING INSTALLED.
5. INSTALL ALL EQUIPMENT MATERIAL AND ACCESSORY DEVICES PER MANUFACTURERS INSTRUCTIONS UNLESS OTHERWISE DIRECTED BY THE OWNER/ENGINEER. ENSURE MAINTENANCE ACCESS IS PROVIDED.
6. COORDINATE ALL PLUMBING UTILITIES SHUT DOWNS WITH THE OWNER. ANY SHUT DOWNS NECESSARY TO ACHIEVE THE OBJECTIVE OF THIS DESIGN SHALL BE COMPLETED DURING "OFF HOURS" AND SHALL COMPLY WITH THE OWNER'S UTILITY SHUT DOWN POLICIES.
7. CONTRACTOR IS RESPONSIBLE FOR ALL CUTTING, PATCHING AND DEMOLITION PER THEIR MEANS-AND-METHODS AS NECESSARY TO PROVIDE THE DESIGN INDICATED.
8. VERIFY LOCATION OF ALL EXISTING UTILITIES BEFORE LAYING OUT AND MAKING CONNECTIONS. REPORT ANY INCONSISTENCIES TO THE OWNER/ENGINEER BEFORE COMMENCING WORK. CONTRACTORS SHALL BE RESPONSIBLE FOR ANY ERROR RESULTING FROM FAILURE TO EXERCISE THESE PRECAUTIONS.
9. UNLESS SPECIFICALLY PROVIDED OTHERWISE, ALL MATERIALS AND EQUIPMENT FURNISHED FOR PERMANENT INSTALLATION SHALL CONFORM TO ALL APPLICABLE STANDARDS AND BE NEW, CURRENT DESIGN, UNUSED AND UNDAMAGED.
10. THE CONTRACTOR SHALL VERIFY IN THE FIELD EXACT SIZES AND LOCATION OF ALL EXISTING PLUMBING PIPING PRIOR TO INSTALLATION OF ANY NEW PLUMBING WORK. NEW PLUMBING WORK SHALL BE COORDINATED WITH EXISTING CONDITIONS TO ASSURE PROPER INSTALLATION.
11. ANY PIPING WHICH MUST REMAIN AS PART OF AN ACTIVE SYSTEM AND IS IN CONFLICT WITH THE NEW LAYOUT SHALL BE RELOCATED AT NO COST TO THE OWNER.
12. EXCEPT WHERE OTHERWISE INDICATED ON THE DRAWINGS, PIPING IS SHOWN ON THE FLOOR WHERE IT ACTUALLY OCCURS IN THE BUILDING.
13. PIPING SHALL TYPICALLY BE RUN ABOVE THE CEILINGS AND CONCEALED WITHIN WALLS, EXCEPT FOR UNDER SLAB DRAINAGE OR IN DESIGNATED MECHANICAL ROOMS.
14. ALL SANITARY AND STORM PIPING 3" AND LARGER SHALL BE INSTALLED AT 1/8" PER FOOT SLOPE UNLESS OTHERWISE NOTED. SANITARY PIPING 2-1/2" OR SMALLER SHALL BE INSTALLED AT 1/4" PER FOOT SLOPE UNLESS OTHERWISE NOTED.
15. ALL DOMESTIC WATER SYSTEMS, WHERE NEW OR RELOCATED AND PLACED BACK IN SERVICE, SHALL BE DISINFECTED PRIOR TO UTILIZATION PER SECTION 610 OF THE INTERNATIONAL PLUMBING CODE. PREPARE TEST SAMPLES AND SUBMIT TO A TESTING LABORATORY. PRESENT OWNER AND ENGINEER WITH TEST RESULTS.
16. ALL PIPING SHALL BE PRESSURE TESTED AT THE WORKING PRESSURE INDICATED FOR A PERIOD OF 24 HOURS. STOP-LEAK COMPOUNDS WILL NOT BE ALLOWED.
17. ALL PIPE PENETRATIONS THROUGH FLOORS OR FIRE RATED WALLS SHALL BE PROVIDED WITH SLEEVES, FIRE SAFING MATERIAL AND CAULKING TO MATCH THE FIRE RATING OF THE RESPECTIVE FLOORS OR WALLS. REFER TO ARCHITECTURAL DRAWINGS FOR APPROPRIATE WALL RATINGS.
18. THE CONTRACTOR SHALL MAKE ALL EQUIPMENT AND FIXTURE FINAL CONNECTIONS FOR BOTH CONTRACTOR AND OWNER PROVIDED FIXTURES. PROVIDE THE NECESSARY ADAPTERS, FITTINGS, VALVES, DEVICES, ETC. FOR A COMPLETE OPERABLE SYSTEM. THE CONTRACTOR SHALL REFER TO THE ARCHITECTURAL DOCUMENTS FOR ADDITIONAL INFORMATION AND SHALL COORDINATE EXACT LOCATIONS OF ALL FIXTURES WITH ARCHITECTURAL DRAWINGS.
19. NO SANITARY, SOIL OR WASTE PIPE SHALL EXTEND MORE THAN 2'-0" TO A DEAD END. CLEANOUTS SHALL BE PROVIDED AS REQUIRED BY THE LOCAL AUTHORITY.
20. ALL PIPING SHALL BE SUPPORTED FROM STRUCTURE WITH UL LISTED HANGERS AND SUPPORTS SUITABLE FOR THE INTENDED INSTALLATION. DESIGN, SELECTION, SPACING AND APPLICATION OF HANGERS AND SUPPORTS SHALL COMPLY WITH ANSI B31.1 AND MSS SP-69.
21. FIXTURES SHALL BE PROTECTED DURING CONSTRUCTION FROM DIRT AND PHYSICAL DAMAGE. DIRTY FIXTURES SHALL BE CLEANED AND DAMAGED PARTS OF FIXTURES SHALL BE REPLACED.
22. INSTALL FLOOR DRAINS A MINIMUM OF 1/8" LOWER THAN THE FINISHED FLOOR. TAPER CONCRETE TO THE DRAIN.
23. DURING CONSTRUCTION, AN ACCURATE RECORD OF ALL DEVIATIONS BETWEEN WORK SHOWN ON THE DRAWINGS AND THAT WHICH IS ACTUALLY INSTALLED SHALL BE MAINTAINED. THESE DEVIATIONS SHALL BE NOTED NEATLY AND ACCURATELY IN RED INK ON A SET OF PLUMBING PRINTS. WHEN ALL REVISIONS HAVE BEEN SHOWN ON THESE PRINTS TO INDICATE THE WORK AS ACTUALLY INSTALLED, THE PRINTS SHALL BE DELIVERED TO THE OWNER IN TRIPLICATE.
24. INSTALL PIPING IN MECHANICAL AND UTILITY SPACES AS HIGH AS POSSIBLE. PROVIDE ADEQUATE CLEARANCE FOR REMOVAL AND SERVICING OF ALL EQUIPMENT INCLUDING MAJOR EQUIPMENT.
25. CONTRACTOR SHALL IDENTIFY AND COORDINATE WITH THE OWNER ALL WORK AREAS REQUIRING CONSTRUCTION EFFORTS DURING HOSPITAL "OFF" HOURS. "OFF" HOUR WORK SHALL BE INCLUDED IN THE CONTRACTOR BID/SCOPE OF WORK.
26. CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL ISOLATION VALVES NECESSARY TO COMPLETE THE DESIGN INDICATED.
27. ALL DOMESTIC WATER PIPING, VALVES AND DEVICES SHALL BE COMPLIANT WITH THE 2011 REDUCTION OF LEAD IN DRINKING WATER ACT. THIS INCLUDES ALL PIPING FOR DISTRIBUTION OR CONNECTION TO FIXTURES OR EQUIPMENT. THE CONTRACTOR SHALL COORDINATE EXEMPTIONS OF ANY NON-POTABLE USES (EX. SHOWER VALVES, BACKFLOW PREVENTERS FOR MECHANICAL SYSTEM MAKEUP WATER) WITH THE AHJ AND OBTAIN APPROVAL BEFORE ORDERING MATERIALS OR INSTALLING COMPONENTS.

MEP DESIGN SUMMARY

PROJECT INFORMATION

PROJECT NAME:	FARMERS MARKET RESTROOM RENOVATION
ADDRESS:	345 SOUTH MAIN STREET HARRISONBURG, VA. 22801
PROPOSED USE:	OFFICE AND PUBLIC RESTROOMS
OWNER:	CITY OF HARRISONBURG
OWNER CONTACT:	ADAM WRIGHT
PHONE:	540-560-9455
VE PROJ. NO.:	10895-3

APPLICABLE CODES

BUILDING CODE:	VIRGINIA REHABILITATION CODE: 2012 WORK COMPLIANCE METHOD
MECHANICAL CODE:	VIRGINIA MECHANICAL CODE: 2012
PLUMBING CODE:	VIRGINIA PLUMBING CODE: 2012
ELECTRICAL CODE:	NFPA 70, 2011 NATIONAL ELECTRICAL CODE
ACCESSIBILITY CODE:	ICC/ANSI A117.1 2009 STANDARDS ON ACCESSIBLE AND USABLE BUILDING AND FACILITIES
GAS CODE:	VIRGINIA FUEL GAS CODE: 2012

PROJECT TEAM

PROJECT MANAGER:	PHIL GENTRY
PROJECT TEAM:	JOHN SOLDANO – HVAC ENGINEER MATT SHOCKEY – PLUMBING ENGINEER KEVIN KLINE – ELECTRICAL ENGINEER TED ENOSAKI – STRUCTURAL ENGINEER TIM HOUSDEN – ELECTRICAL DESIGNER

DRAWING LIST

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

PLUMBING LEGENDS, ABBREVIATIONS, AND NOTES

SHEET NO.:
P0.01

(NOT ALL SPECIFICATIONS APPLY TO THIS PROJECT)
SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

<u>PART 1 – GENERAL</u>

1.1 SUMMARY
- A. ALL SECTIONS OF THIS SPECIFICATION ARE <u>NOT</u> REQUIRED FOR THIS PROJECT. COORDINATE SECTIONS AND NEED AS REQUIRED BY SYSTEMS AND LOCATION INSTALLED.
- B. THIS SECTION INCLUDES THE FOLLOWING:
  1. PIPING MATERIALS AND INSTALLATION INSTRUCTIONS COMMON TO MOST PIPING SYSTEMS.
  2. DIELECTRIC FITTINGS.
  3. MECHANICAL SLEEVE SEALS.
  4. SLEEVES.
  5. ESCUTCHEONS.
  6. GROUT.
  7. PLUMBING DEMOLITION.
  8. EQUIPMENT INSTALLATION REQUIREMENTS COMMON TO EQUIPMENT SECTIONS.
  9. CONCRETE BASES.
  10. SUPPORTS AND ANCHORAGES.

1.2 DEFINITIONS
- A. FINISHED SPACES: SPACES OTHER THAN PLUMBING AND ELECTRICAL EQUIPMENT ROOMS, FURRED SPACES, PIPE CHASES, UNHEATED SPACES IMMEDIATELY BELOW ROOF, SPACES ABOVE CEILINGS, UNEXCAVATED SPACES, CRAWLSPACES, AND TUNNELS.
- B. EXPOSED, INTERIOR INSTALLATIONS: EXPOSED TO VIEW INDOORS. EXAMPLES INCLUDE FINISHED OCCUPIED SPACES AND PLUMBING EQUIPMENT ROOMS.
- C. EXPOSED, EXTERIOR INSTALLATIONS: EXPOSED TO VIEW OUTDOORS OR SUBJECT TO OUTDOOR AMBIENT TEMPERATURES AND WEATHER CONDITIONS. EXAMPLES INCLUDE ROOFTOP LOCATIONS.
- D. CONCEALED, INTERIOR INSTALLATIONS: CONCEALED FROM VIEW AND PROTECTED FROM PHYSICAL CONTACT BY BUILDING OCCUPANTS. EXAMPLES INCLUDE ABOVE CEILINGS AND IN CHASES.
- E. CONCEALED, EXTERIOR INSTALLATIONS: CONCEALED FROM VIEW AND PROTECTED FROM WEATHER CONDITIONS AND PHYSICAL CONTACT BY BUILDING OCCUPANTS BUT SUBJECT TO OUTDOOR AMBIENT TEMPERATURES. EXAMPLES INCLUDE INSTALLATIONS WITHIN UNHEATED SHELTERS.

1.3 QUALITY ASSURANCE
- A. STEEL SUPPORT WELDING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO AWS D1.1, "STRUCTURAL WELDING CODE--STEEL."
- B. ELECTRICAL CHARACTERISTICS FOR PLUMBING EQUIPMENT: EQUIPMENT OF HIGHER ELECTRICAL CHARACTERISTICS MAY BE FURNISHED PROVIDED SUCH PROPOSED EQUIPMENT IS APPROVED IN WRITING AND CONNECTING ELECTRICAL SERVICES, CIRCUIT BREAKERS, AND CONDUIT SIZES ARE PPROPRIATELY MODIFIED. IF MINIMUM ENERGY RATINGS OR EFFICIENCIES ARE SPECIFIED, EQUIPMENT SHALL COMPLY WITH REQUIREMENTS.

<u>PART 2 – PRODUCTS</u>

2.1 PIPE, TUBE, AND FITTINGS
- A. PIPE THREADS: ASME B1.20.1 FOR FACTORY-THREADED PIPE AND PIPE FITTINGS.

2.2 JOINING MATERIALS
- A. REFER TO INDIVIDUAL PIPING SECTIONS FOR SPECIAL JOINING MATERIALS NOT LISTED BELOW.
- B. PIPE-FLANGE GASKET MATERIALS: ASME B16.21, NONMETALLIC, FLAT, ASBESTOS-FREE, 1/8-INCH MAXIMUM THICKNESS UNLESS THICKNESS OR SPECIFIC MATERIAL IS INDICATED.
- C. PLASTIC, PIPE-FLANGE GASKET, BOLTS, AND NUTS: TYPE AND MATERIAL RECOMMENDED BY PIPING SYSTEM MANUFACTURER, UNLESS OTHERWISE INDICATED.
- D. SOLDER FILLER METALS: ASTM B 32, LEAD-FREE ALLOYS. INCLUDE WATER-FLUSHABLE FLUX ACCORDING TO ASTM B 813.
- E. BRAZING FILLER METALS: AWS A5.8, BCUP SERIES OR BAG1, UNLESS OTHERWISE INDICATED.
- F. WELDING FILLER METALS: COMPLY WITH AWS D10.12.
  1. SOLVENT CEMENTS FOR JOINING PLASTIC PIPING:
  2. ABS PIPING: ASTM D 2235.
  3. CPVC PIPING: ASTM F 493.
  4. PVC PIPING: ASTM D 2564. INCLUDE PRIMER ACCORDING TO ASTM F 656.
  5. PVC TO ABS PIPING TRANSITION: ASTM D 3138.

2.3 DIELECTRIC FITTINGS
- A. DESCRIPTION: COMBINATION FITTING OF COPPER ALLOY AND FERROUS MATERIALS WITH THREADED, SOLDER-JOINT, PLAIN, OR WELD-NECK END CONNECTIONS THAT MATCH PIPING SYSTEM MATERIALS.
- B. INSULATING MATERIAL: SUITABLE FOR SYSTEM FLUID, PRESSURE, AND TEMPERATURE.
- C. DIELECTRIC UNIONS: FACTORY-FABRICATED, UNION ASSEMBLY, FOR 250-PSIG MINIMUM WORKING PRESSURE AT 180 DEG F.
- D. DIELECTRIC FLANGES: FACTORY-FABRICATED, COMPANION-FLANGE ASSEMBLY, FOR 150- OR 300-PSIG MINIMUM WORKING PRESSURE AS REQUIRED TO SUIT SYSTEM PRESSURES.
- E. DIELECTRIC COUPLINGS: GALVANIZED-STEEL COUPLING WITH INERT AND NONCORROSIVE, THERMOPLASTIC LINING; THREADED ENDS; AND 300-PSIG MINIMUM WORKING PRESSURE AT 225°F.
- F. DIELECTRIC NIPPLES: ELECTROPLATED STEEL NIPPLE WITH INERT AND NONCORROSIVE, THERMOPLASTIC LINING; PLAIN, THREADED, OR GROOVED ENDS; AND 300-PSIG MINIMUM WORKING PRESSURE AT 225°F.

2.4 MECHANICAL SLEEVE SEALS
- A. DESCRIPTION: MODULAR SEALING ELEMENT UNIT, DESIGNED FOR FIELD ASSEMBLY, TO FILL ANNULAR SPACE BETWEEN PIPE AND SLEEVE.
- B. SEALING ELEMENTS: EPDM INTERLOCKING LINKS SHAPED TO FIT SURFACE OF PIPE. INCLUDE TYPE AND NUMBER REQUIRED FOR PIPE MATERIAL AND SIZE OF PIPE.
- C. PRESSURE PLATES: STAINLESS STEEL. INCLUDE TWO FOR EACH SEALING ELEMENT.
- D. CONNECTING BOLTS AND NUTS: STAINLESS STEEL OF LENGTH REQUIRED TO SECURE PRESSURE PLATES TO SEALING ELEMENTS. INCLUDE ONE FOR EACH SEALING ELEMENT.

2.5 SLEEVES
- A. GALVANIZED-STEEL SHEET: 0.0239-INCH MINIMUM THICKNESS; ROUND TUBE CLOSED WITH WELDED LONGITUDINAL JOINT.
- B. STEEL PIPE: ASTM A 53, TYPE E, GRADE B, SCHEDULE 40, GALVANIZED, PLAIN ENDS.
- C. CAST IRON: CAST OR FABRICATED "WALL PIPE" EQUIVALENT TO DUCTILE-IRON PRESSURE PIPE, WITH PLAIN ENDS AND INTEGRAL WATERSTOP, UNLESS OTHERWISE INDICATED.
- D. STACK SLEEVE FITTINGS: MANUFACTURED, CAST-IRON SLEEVE WITH INTEGRAL CLAMPING FLANGE. INCLUDE CLAMPING RING AND BOLTS AND NUTS FOR MEMBRANE FLASHING.
  1. UNDERDECK CLAMP: CLAMPING RING WITH SET SCREWS.
- E. MOLDED PVC: PERMANENT, WITH NAILING FLANGE FOR ATTACHING TO WOODEN FORMS.
- F. PVC PIPE: ASTM D 1785, SCHEDULE 40.
- G. MOLDED PE: REUSABLE, PE, TAPERED-CUP SHAPED, AND SMOOTH-OUTER SURFACE WITH NAILING FLANGE FOR ATTACHING TO WOODEN FORMS.

2.6 ESCUTCHEONS
- A. DESCRIPTION: MANUFACTURED WALL AND CEILING ESCUTCHEONS AND FLOOR PLATES, WITH AN ID TO CLOSELY FIT AROUND PIPE, TUBE, AND INSULATION OF INSULATED PIPING AND AN OD THAT COMPLETELY COVERS OPENING.
- B. ONE-PIECE, DEEP-PATTERN TYPE: DEEP-DRAWN, BOX-SHAPED BRASS WITH POLISHED CHROME-PLATED FINISH.
- C. ONE-PIECE, CAST-BRASS TYPE: WITH SET SCREW.
  1. FINISH: POLISHED CHROME-PLATED.
- D. SPLIT-CASTING, CAST-BRASS TYPE: WITH CONCEALED HINGE AND SET SCREW.
  2. FINISH: POLISHED CHROME-PLATED.

2.7 GROUT
- A. DESCRIPTION: ASTM C 1107, GRADE B, NONSHRINK AND NONMETALLIC, DRY HYDRAULIC-CEMENT GROUT.
  1. CHARACTERISTICS: POST-HARDENING, VOLUME-ADJUSTING, NONSTAINING, NONCORROSIVE, NONGASEOUS, AND RECOMMENDED FOR INTERIOR AND EXTERIOR APPLICATIONS.
  2. DESIGN MIX: 5000-PSI, 28-DAY COMPRESSIVE STRENGTH.
  3. PACKAGING: PREMIXED AND FACTORY PACKAGED.

<u>PART 3 – EXECUTION</u>

3.1 PLUMBING DEMOLITION
- A. DISCONNECT, DEMOLISH, AND REMOVE PLUMBING SYSTEMS, EQUIPMENT, AND COMPONENTS INDICATED TO BE REMOVED.
  1. PIPING TO BE REMOVED: REMOVE PORTION OF PIPING INDICATED TO BE REMOVED AND CAP OR PLUG REMAINING PIPING WITH SAME OR COMPATIBLE PIPING MATERIAL.
  2. PIPING TO BE ABANDONED IN PLACE: DRAIN PIPING AND CAP OR PLUG PIPING WITH SAME OR COMPATIBLE PIPING MATERIAL.
  3. EQUIPMENT TO BE REMOVED: DISCONNECT AND CAP SERVICES AND REMOVE EQUIPMENT.
  4. EQUIPMENT TO BE REMOVED AND REINSTALLED: DISCONNECT AND CAP SERVICES AND REMOVE, CLEAN, AND STORE EQUIPMENT; WHEN APPROPRIATE, REINSTALL, RECONNECT, AND MAKE EQUIPMENT OPERATIONAL.
  5. EQUIPMENT TO BE REMOVED AND SALVAGED: DISCONNECT AND CAP SERVICES AND REMOVE EQUIPMENT AND DELIVER TO OWNER.
- B. IF PIPE, INSULATION, OR EQUIPMENT TO REMAIN IS DAMAGED IN APPEARANCE OR IS UNSERVICEABLE, REMOVE DAMAGED OR UNSERVICEABLE PORTIONS AND REPLACE WITH NEW PRODUCTS OF EQUAL CAPACITY AND QUALITY.

3.2 PIPING SYSTEMS – COMMON REQUIREMENTS
- A. INSTALL PIPING ACCORDING TO THE REQUIREMENTS STATED HERIN AND ANY APPLICAPLE RECOGNIZED STANDARDS.
- B. DRAWING PLANS, SCHEMATICS, AND DIAGRAMS INDICATE GENERAL LOCATION AND ARRANGEMENT OF PIPING SYSTEMS. INDICATED LOCATIONS AND ARRANGEMENTS WERE USED TO SIZE PIPE AND CALCULATE FRICTION LOSS, EXPANSION, PUMP SIZING, AND OTHER DESIGN CONSIDERATIONS. INSTALL PIPING AS INDICATED UNLESS DEVIATIONS TO LAYOUT ARE APPROVED ON COORDINATION DRAWINGS.
- C. INSTALL PIPING IN CONCEALED LOCATIONS, UNLESS OTHERWISE INDICATED AND EXCEPT IN EQUIPMENT ROOMS AND SERVICE AREAS.
- D. INSTALL PIPING INDICATED TO BE EXPOSED AND PIPING IN EQUIPMENT ROOMS AND SERVICE AREAS AT RIGHT ANGLES OR PARALLEL TO BUILDING WALLS. DIAGONAL RUNS ARE PROHIBITED UNLESS SPECIFICALLY INDICATED OTHERWISE.
- E. INSTALL PIPING ABOVE ACCESSIBLE CEILINGS TO ALLOW SUFFICIENT SPACE FOR CEILING PANEL REMOVAL.
- F. INSTALL PIPING TO PERMIT VALVE SERVICING.
- G. INSTALL PIPING AT INDICATED SLOPES.
- H. INSTALL PIPING FREE OF SAGS AND BENDS.
- I. INSTALL FITTINGS FOR CHANGES IN DIRECTION AND BRANCH CONNECTIONS.
- J. INSTALL PIPING TO ALLOW APPLICATION OF INSULATION.
- K. SELECT SYSTEM COMPONENTS WITH PRESSURE RATING EQUAL TO OR GREATER THAN SYSTEM OPERATING PRESSURE.
- L. INSTALL ESCUTCHEONS FOR PENETRATIONS OF WALLS, CEILINGS, AND FLOORS.
- M. INSTALL SLEEVES FOR PIPES PASSING THROUGH CONCRETE AND MASONRY WALLS, GYPSUM-BOARD PARTITIONS, AND CONCRETE FLOOR AND ROOF SLABS.
- N. ABOVEGROUND, EXTERIOR-WALL PIPE PENETRATIONS: SEAL PENETRATIONS USING SLEEVES AND MECHANICAL SLEEVE SEALS. SELECT SLEEVE SIZE TO ALLOW FOR 1-INCH ANNULAR CLEAR SPACE BETWEEN PIPE AND SLEEVE FOR INSTALLING MECHANICAL SLEEVE SEALS.
  1. INSTALL STEEL PIPE FOR SLEEVES SMALLER THAN 6 INCHES IN DIAMETER.
  2. INSTALL CAST-IRON "WALL PIPES" FOR SLEEVES 6 INCHES AND LARGER IN DIAMETER.
  3. MECHANICAL SLEEVE SEAL INSTALLATION: SELECT TYPE AND NUMBER OF SEALING ELEMENTS REQUIRED FOR PIPE MATERIAL AND SIZE. POSITION PIPE IN CENTER OF SLEEVE. ASSEMBLE MECHANICAL SLEEVE SEALS AND INSTALL IN ANNULAR SPACE BETWEEN PIPE AND TIGHTEN BOLTS AGAINST PRESSURE PLATES THAT CAUSE SEALING ELEMENTS TO EXPAND AND MAKE WATERTIGHT SEAL.
- O. UNDERGROUND, EXTERIOR-WALL PIPE PENETRATIONS: INSTALL CAST-IRON "WALL PIPES" FOR SLEEVES. SEAL PIPE PENETRATIONS USING MECHANICAL SLEEVE SEALS. SELECT SLEEVE SIZE TO ALLOW FOR 1-INCH ANNULAR CLEAR SPACE BETWEEN PIPE AND SLEEVE FOR INSTALLING MECHANICAL SLEEVE SEALS.
  1. MECHANICAL SLEEVE SEAL INSTALLATION: SELECT TYPE AND NUMBER OF SEALING ELEMENTS REQUIRED FOR PIPE MATERIAL AND SIZE.POSITION PIPE IN CENTER OF SLEEVE. ASSEMBLE MECHANICAL SLEEVE SEALS AND INSTALL IN ANNULAR SPACE BETWEEN PIPE ANDTIGHTEN BOLTS AGAINST PRESSURE PLATES THAT CAUSE SEALING ELEMENTS TO EXPAND AND MAKE WATERTIGHT SEAL.
- P. FIRE-BARRIER PENETRATIONS: MAINTAIN INDICATED FIRE RATING OF WALLS, PARTITIONS, CEILINGS, AND FLOORS AT PIPE PENETRATIONS. SEAL PIPE PENETRATIONS WITH FIRESTOP MATERIALS. REFER TO DIVISION 07 SECTION "PENETRATION FIRESTOPPING" FOR MATERIALS.
- Q. VERIFY FINAL EQUIPMENT LOCATIONS FOR ROUGHING-IN.
- R. REFER TO EQUIPMENT SPECIFICATIONS IN OTHER SECTIONS OF THESE SPECIFICATIONS FOR ROUGHING-IN REQUIREMENTS.

3.3 PIPING JOINT CONSTRUCTION
- A. JOIN PIPE AND FITTINGS ACCORDING TO THE FOLLOWING REQUIREMENTS AND DIVISION 22 SECTIONS SPECIFYING PIPING SYSTEMS.
- B. REAM ENDS OF PIPES AND TUBES AND REMOVE BURRS. BEVEL PLAIN ENDS OF STEEL PIPE.
- C. REMOVE SCALE, SLAG, DIRT, AND DEBRIS FROM INSIDE AND OUTSIDE OF PIPE AND FITTINGS BEFORE ASSEMBLY.
- D. SOLDERED JOINTS: APPLY ASTM B 813, WATER-FLUSHABLE FLUX, UNLESS OTHERWISE INDICATED, TO TUBE END. CONSTRUCT JOINTS ACCORDING TO ASTM B 828 OR CDA'S "COPPER TUBE HANDBOOK," USING LEAD-FREE SOLDER ALLOY COMPLYING WITH ASTM B 32.
- E. BRAZED JOINTS: CONSTRUCT JOINTS ACCORDING TO AWS'S "BRAZING HANDBOOK," "PIPE AND TUBE" CHAPTER, USING COPPER-PHOSPHORUS BRAZING FILLER METAL COMPLYING WITH AWS A5.8.
- F. THREADED JOINTS: THREAD PIPE WITH TAPERED PIPE THREADS ACCORDING TO ASME B1.20.1. CUT THREADS FULL AND CLEAN USING SHARP REAM THREADED PIPE ENDS TO REMOVE BURRS AND RESTORE FULL ID. JOIN PIPE FITTINGS AND VALVES AS FOLLOWS:
  1. APPLY APPROPRIATE TAPE OR THREAD COMPOUND TO EXTERNAL PIPE THREADS UNLESS DRY SEAL THREADING IS SPECIFIED.
  2. DAMAGED THREADS: DO NOT USE PIPE OR PIPE FITTINGS WITH THREADS THAT ARE CORRODED OR DAMAGED. DO NOT USE PIPE SECTIONS THAT HAVE CRACKED OR OPEN WELDS.
- G. WELDED JOINTS: CONSTRUCT JOINTS ACCORDING TO AWS D10.12, USING QUALIFIED PROCESSES AND WELDING OPERATORS ACCORDING TO PART 1 "QUALITY ASSURANCE" ARTICLE.
- H. FLANGED JOINTS: SELECT APPROPRIATE GASKET MATERIAL, SIZE, TYPE, AND THICKNESS FOR SERVICE APPLICATION. INSTALL GASKET CONCENTRICALLY POSITIONED. USE SUITABLE LUBRICANTS ON BOLT THREADS.
- I. PLASTIC PIPING SOLVENT-CEMENT JOINTS: CLEAN AND DRY JOINING SURFACES. JOIN PIPE AND FITTINGS ACCORDING TO THE FOLLOWING:
  1. COMPLY WITH ASTM F 402, FOR SAFE-HANDLING PRACTICE OF CLEANERS, PRIMERS, AND SOLVENT CEMENTS.
  2. ABS PIPING: JOIN ACCORDING TO ASTM D 2235 AND ASTM D 2661 APPENDIXES.
  3. CPVC PIPING: JOIN ACCORDING TO ASTM D 2846/D 2846M APPENDIX.
  4. PVC PRESSURE PIPING: JOIN SCHEDULE NUMBER ASTM D 1785, PVC PIPE AND PVC SOCKET FITTINGS ACCORDING TO ASTM D 2672. JOIN OTHER-THAN-SCHEDULE-NUMBER PVC PIPE AND SOCKET FITTINGS ACCORDING TO ASTM D 2855.
  5. PVC NONPRESSURE PIPING: JOIN ACCORDING TO ASTM D 2855.
  6. PVC TO ABS NONPRESSURE TRANSITION FITTINGS: JOIN ACCORDING TO ASTM D 3138 APPENDIX.
- J. PLASTIC PRESSURE PIPING GASKETED JOINTS: JOIN ACCORDING TO ASTM D 3139.
- K. PLASTIC NONPRESSURE PIPING GASKETED JOINTS: JOIN ACCORDING TO ASTM D 3212.
- L. PE PIPING HEAT-FUSION JOINTS: CLEAN AND DRY JOINING SURFACES BY WIPING WITH CLEAN CLOTH OR PAPER TOWELS. JOIN ACCORDING TO ASTM D 2657.
  1. PLAIN-END PIPE AND FITTINGS: USE BUTT FUSION.
  2. PLAIN-END PIPE AND SOCKET FITTINGS: USE SOCKET FUSION.
- M. FIBERGLASS BONDED JOINTS: PREPARE PIPE ENDS AND FITTINGS, APPLY ADHESIVE, AND JOIN ACCORDING TO PIPE MANUFACTURER'S WRITTEN INSTRUCTIONS.

3.4 PIPING CONNECTIONS
- A. MAKE CONNECTIONS ACCORDING TO THE FOLLOWING, UNLESS OTHERWISE INDICATED:
  1. INSTALL UNIONS, IN PIPING NPS 2 AND SMALLER, ADJACENT TO EACH VALVE AND AT FINAL CONNECTION TO EACH PIECE OF EQUIPMENT.
  2. INSTALL FLANGES, IN PIPING NPS 2-1/2 AND LARGER, ADJACENT TO FLANGED VALVES AND AT FINAL CONNECTION TO EACH PIECE OF EQUIPMENT.
  3. DRY PIPING SYSTEMS: INSTALL DIELECTRIC UNIONS AND FLANGES TO CONNECT PIPING MATERIALS OF DISSIMILAR METALS.
  4. WET PIPING SYSTEMS: INSTALL DIELECTRIC COUPLING AND NIPPLE FITTINGS TO CONNECT PIPING MATERIALS OF DISSIMILAR METALS.

3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS
- A. INSTALL EQUIPMENT TO ALLOW MAXIMUM POSSIBLE HEADROOM UNLESS SPECIFIC MOUNTING HEIGHTS ARE NOT INDICATED.
- B. INSTALL EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS IN EXPOSED INTERIOR SPACES, UNLESS OTHERWISE INDICATED.
- C. INSTALL PLUMBING EQUIPMENT TO FACILITATE SERVICE, MAINTENANCE, AND REPAIR OR REPLACEMENT OF COMPONENTS. CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM INTERFERENCE TO OTHER INSTALLATIONS. EXTEND GREASE FITTINGS TO ACCESSIBLE LOCATIONS.
- D. INSTALL EQUIPMENT TO ALLOW RIGHT OF WAY FOR PIPING INSTALLED AT REQUIRED SLOPE.

3.6 CONCRETE BASES
- A. CONCRETE BASES: ANCHOR EQUIPMENT TO CONCRETE BASE ACCORDING TO EQUIPMENT MANUFACTURER'S WRITTEN INSTRUCTIONS AND ACCORDING TO SEISMIC CODES AT PROJECT.
  1. CONSTRUCT CONCRETE BASES OF DIMENSIONS INDICATED, BUT NOT LESS THAN 4 INCHES LARGER IN BOTH DIRECTIONS THAN SUPPORTED UNIT.
  2. ISTALL DOWEL RODS TO CONNECT CONCRETE BASE TO CONCRETE FLOOR. UNLESS OTHERWISE INDICATED, INSTALL DOWEL RODS ON 18-INCH CENTERS AROUND THE FULL PERIMETER OF THE BASE.
  3. INSTALL EPOXY-COATED ANCHOR BOLTS FOR SUPPORTED EQUIPMENT THAT EXTEND THROUGH CONCRETE BASE, AND ANCHOR INTO STRUCTURAL CONCRETE FLOOR.
  4. PLACE AND SECURE ANCHORAGE DEVICES. USE SUPPORTED EQUIPMENT MANUFACTURER'S SETTING DRAWINGS, TEMPLATES, DIAGRAMS, INSTRUCTIONS, AND DIRECTIONS FURNISHED WITH ITEMS TO BE EMBEDDED.
  5. INSTALL ANCHOR BOLTS TO ELEVATIONS REQUIRED FOR PROPER ATTACHMENT TO SUPPORTED EQUIPMENT.
  6. INSTALL ANCHOR BOLTS ACCORDING TO ANCHOR-BOLT MANUFACTURER'S WRITTEN INSTRUCTIONS.
  7. USE 3000-PSI, 28-DAY COMPRESSIVE-STRENGTH CONCRETE AND REINFORCEMENT.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES
- B. CUT, FIT, AND PLACE MISCELLANEOUS METAL SUPPORTS ACCURATELY IN LOCATION, ALIGNMENT, AND ELEVATION TO SUPPORT AND ANCHOR PLUMBING MATERIALS AND EQUIPMENT.
- C. FIELD WELDING: COMPLY WITH AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES
- A. CUT, FIT, AND PLACE WOOD GROUNDS, NAILERS, BLOCKING, AND ANCHORAGES TO SUPPORT, AND ANCHOR PLUMBING MATERIALS AND EQUIPMENT.
- B. SELECT FASTENER SIZES THAT WILL NOT PENETRATE MEMBERS IF OPPOSITE SIDE WILL BE EXPOSED TO VIEW OR WILL RECEIVE FINISH MATERIALS. TIGHTEN CONNECTIONS BETWEEN MEMBERS. INSTALL FASTENERS WITHOUT SPLITTING WOOD MEMBERS.
- C. ATTACH TO SUBSTRATES AS REQUIRED TO SUPPORT APPLIED LOADS.

3.9 GROUTING
- A. MIX AND INSTALL GROUT FOR PLUMBING EQUIPMENT BASE BEARING SURFACES, PUMP AND OTHER EQUIPMENT BASE PLATES, AND ANCHORS.
- B. CLEAN SURFACES THAT WILL COME INTO CONTACT WITH GROUT.
- C. PROVIDE FORMS AS REQUIRED FOR PLACEMENT OF GROUT.
- D. AVOID AIR ENTRAPMENT DURING PLACEMENT OF GROUT.
- E. PLACE GROUT, COMPLETELY FILLING EQUIPMENT BASES.
- F. PLACE GROUT ON CONCRETE BASES AND PROVIDE SMOOTH BEARING SURFACE FOR EQUIPMENT.
- G. PLACE GROUT AROUND ANCHORS.
- H. CURE PLACED GROUT.

SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

<u>PART 1 – GENERAL</u>

1.1 SUMMARY
- A. ALL SECTIONS OF THIS SPECIFICATION ARE <u>NOT</u> REQUIRED FOR THIS PROJECT. COORDINATE SECTIONS AND NEED AS REQUIRED BY SYSTEMS AND LOCATION INSTALLED.
- B. THIS SECTION INCLUDES THE FOLLOWING:
  1. STEEL PIPE HANGERS AND SUPPORTS.
  2. TRAPEZE PIPE HANGERS.
  3. METAL FRAMING SYSTEMS.
  4. THERMAL-HANGER SHIELD INSERTS.
  5. FASTENER SYSTEMS.
  6. EQUIPMENT SUPPORTS.

1.2 DEFINITIONS
- A. TERMINOLOGY: AS DEFINED IN MSS SP-90, "GUIDELINES ON TERMINOLOGY FOR PIPE HANGERS AND SUPPORTS."

1.3 PERFORMANCE REQUIREMENTS
- A. DESIGN SUPPORTS FOR MULTIPLE PIPES CAPABLE OF SUPPORTING COMBINED WEIGHT OF SUPPORTED SYSTEMS, SYSTEM CONTENTS, AND TEST WATER.
- B. DESIGN EQUIPMENT SUPPORTS CAPABLE OF SUPPORTING COMBINED OPERATING WEIGHT OF SUPPORTED EQUIPMENT AND CONNECTED SYSTEMS AND COMPONENTS.

<u>PART 2 – PRODUCTS</u>

2.1 MANUFACTURERS
- A. IN OTHER PART 2 ARTICLES WHERE TITLES BELOW INTRODUCE LISTS, THE FOLLOWING REQUIREMENTS APPLY TO PRODUCT SELECTION:
  1. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE MANUFACTURERS SPECIFIED.

2.2 STEEL PIPE HANGERS AND SUPPORTS
- A. DESCRIPTION: MSS SP-58, TYPES 1 THROUGH 58, FACTORY-FABRICATED COMPONENTS. REFER TO PART 3 "HANGER AND SUPPORT APPLICATIONS" ARTICLE FOR WHERE TO USE SPECIFIC HANGER AND SUPPORT TYPES.
- B. MANUFACTURERS:
  1. B-LINE SYSTEMS, INC.; A DIVISION OF COOPER INDUSTRIES.
  2. EMPIRE INDUSTRIES, INC.
  3. ERICO/MICHIGAN HANGER CO.
  4. GLOBE PIPE HANGER PRODUCTS, INC.
  5. GRINNELL CORP.
  6. NATIONAL PIPE HANGER CORPORATION.
  7. PHD MANUFACTURING, INC.
  8. PHS INDUSTRIES, INC.
  9. PIPING TECHNOLOGY & PRODUCTS, INC.
- C. GALVANIZED, METALLIC COATINGS: PREGALVANIZED OR HOT DIPPED.
- D. NONMETALLIC COATINGS: PLASTIC COATING, JACKET, OR LINER.
- E. PADDED HANGERS: HANGER WITH FIBERGLASS OR OTHER PIPE INSULATION PAD OR CUSHION FOR SUPPORT OF BEARING SURFACE OF PIPING.

2.3 TRAPEZE PIPE HANGERS
- A. DESCRIPTION: MSS SP-69, TYPE 59, SHOP- OR FIELD-FABRICATED PIPE-SUPPORT ASSEMBLY MADE FROM STRUCTURAL-STEEL SHAPES WITH MSS SP-58 HANGER RODS, NUTS, SADDLES, AND U-BOLTS.

2.4 METAL FRAMING SYSTEMS
- A. DESCRIPTION: MFMA-3, SHOP- OR FIELD-FABRICATED PIPE-SUPPORT ASSEMBLY MADE OF STEEL CHANNELS AND OTHER COMPONENTS.
- B. MANUFACTURERS:
  1. B-LINE SYSTEMS, INC.; A DIVISION OF COOPER INDUSTRIES.
  2. ERICO/MICHIGAN HANGER CO.; ERISTRUT DIV.
  3. GS METALS CORP.
  4. POWER-STRUT DIV.; TYCO INTERNATIONAL, LTD.
  5. THOMAS & BETTS CORPORATION.
  6. UNISTRUT CORP.; TYCO INTERNATIONAL, LTD.
- C. COATINGS: MANUFACTURER'S STANDARD FINISH, UNLESS BARE METAL SURFACES ARE INDICATED.
- D. NONMETALLIC COATINGS: PLASTIC COATING, JACKET, OR LINER.

2.5 THERMAL-HANGER SHIELD INSERTS
- A. DESCRIPTION: 100-PSIG- MINIMUM, COMPRESSIVE-STRENGTH INSULATION INSERT ENCASED IN SHEET METAL SHIELD.
- B. MANUFACTURERS:
  1. CARPENTER & PATERSON, INC.
  2. ERICO/MICHIGAN HANGER CO.
  3. PHS INDUSTRIES, INC.
  4. PIPE SHIELDS, INC.
  5. RILCO MANUFACTURING COMPANY, INC.
  6. VALUE ENGINEERED PRODUCTS, INC.
- C. INSULATION-INSERT MATERIAL FOR COLD PIPING: WATER-REPELLENT TREATED, ASTM C 533, TYPE I CALCIUM SILICATE WITH VAPOR BARRIER.
- D. INSULATION-INSERT MATERIAL FOR HOT PIPING: WATER-REPELLENT TREATED, ASTM C 533, TYPE I CALCIUM SILICATE.
- E. FOR TRAPEZE OR CLAMPED SYSTEMS: INSERT AND SHIELD SHALL COVER ENTIRE CIRCUMFERENCE OF PIPE.
- F. FOR CLEVIS OR BAND HANGERS: INSERT AND SHIELD SHALL COVER LOWER 180 DEGREES OF PIPE.
- G. INSERT LENGTH: EXTEND 2 INCHES BEYOND SHEET METAL SHIELD FOR PIPING OPERATING BELOW AMBIENT AIR TEMPERATURE.

2.6 FASTENER SYSTEMS
- A. POWDER-ACTUATED FASTENERS: THREADED-STEEL STUD, FOR USE IN HARDENED PORTLAND CEMENT CONCRETE WITH PULL-OUT, TENSION, AND SHEAR CAPACITIES APPROPRIATE FOR SUPPORTED LOADS AND BUILDING MATERIALS WHERE USED.
  1. MANUFACTURERS:
     - a. HILTI, INC.
     - b. ITW RAMSET/RED HEAD.
     - c. MASTERSET FASTENING SYSTEMS, INC.
     - d. MKT FASTENING, LLC.
     - e. POWERS FASTENERS.
- B. MECHANICAL-EXPANSION ANCHORS: INSERT-WEDGE-TYPE ZINC-COATED STEEL, FOR USE IN HARDENED PORTLAND CEMENT CONCRETE WITH PULL-OUT, TENSION, AND SHEAR CAPACITIES APPROPRIATE FOR SUPPORTED LOADS AND BUILDING MATERIALS WHERE USED.
  1. MANUFACTURERS:
     - a. B-LINE SYSTEMS, INC.; A DIVISION OF COOPER INDUSTRIES.
     - b. EMPIRE INDUSTRIES, INC.
     - c. HILTI, INC.
     - d. ITW RAMSET/RED HEAD.
     - e. MKT FASTENING, LLC.
     - f. POWERS FASTENERS.

2.7 EQUIPMENT SUPPORTS
DESCRIPTION: WELDED, SHOP- OR FIELD-FABRICATED EQUIPMENT SUPPORT MADE FROM STRUCTURAL-STEEL SHAPES.

2.8 MISCELLANEOUS MATERIALS
- A. STRUCTURAL STEEL: ASTM A 36/A 36M, STEEL PLATES, SHAPES, AND BARS; BLACK AND GALVANIZED.
- B. GROUT: ASTM C 1107, FACTORY-MIXED AND -PACKAGED, DRY, HYDRAULIC-CEMENT, NONSHRINK AND NONMETALLIC GROUT; SUITABLE FOR INTERIOR AND EXTERIOR APPLICATIONS.
  1. PROPERTIES: NONSTAINING, NONCORROSIVE, AND NONGASEOUS.
  2. DESIGN MIX: 5000-PSI, 28-DAY COMPRESSIVE STRENGTH.

<u>PART 3 – EXECUTION</u>

3.1 HANGER AND SUPPORT APPLICATIONS
- A. SPECIFIC HANGER AND SUPPORT REQUIREMENTS ARE SPECIFIED IN SECTIONS SPECIFYING PIPING SYSTEMS AND EQUIPMENT.
- B. COMPLY WITH MSS SP-69 FOR PIPE HANGER SELECTIONS AND APPLICATIONS THAT ARE NOT SPECIFIED IN PIPING SYSTEM SECTIONS.
- C. USE HANGERS AND SUPPORTS WITH GALVANIZED, METALLIC COATINGS FOR PIPING AND EQUIPMENT THAT WILL NOT HAVE FIELD-APPLIED FINISH.
- D. USE NONMETALLIC COATINGS ON ATTACHMENTS FOR ELECTROLYTIC PROTECTION WHERE ATTACHMENTS ARE IN DIRECT CONTACT WITH COPPER TUBING.
- E. USE PADDED HANGERS FOR PIPING THAT IS SUBJECT TO SCRATCHING.
- F. HORIZONTAL-PIPING HANGERS AND SUPPORTS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SECTIONS, INSTALL THE FOLLOWING TYPES:
  1. ADJUSTABLE, STEEL CLEVIS HANGERS (MSS TYPE 1): FOR SUSPENSION OF NONINSULATED OR INSULATED STATIONARY PIPES, NPS $\frac{1}{2}$ TO NPS 30.
- G. VERTICAL-PIPING CLAMPS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SECTIONS, INSTALL THE FOLLOWING TYPES:
  1. EXTENSION PIPE OR RISER CLAMPS (MSS TYPE 8): FOR SUPPORT OF PIPE RISERS, NPS 3/4 TO NPS 20.
  2. CARBON- OR ALLOY-STEEL RISER CLAMPS (MSS TYPE 42): FOR SUPPORT OF PIPE RISERS, NPS 3/4 TO NPS 20, IF LONGER ENDS ARE REQUIRED FOR RISER CLAMPS.
- H. HANGER-ROD ATTACHMENTS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SECTIONS, INSTALL THE FOLLOWING TYPES:
  1. STEEL TURNBUCKLES (MSS TYPE 13): FOR ADJUSTMENT UP TO 6 INCHES FOR HEAVY LOADS.
  2. STEEL CLEVISES (MSS TYPE 14): FOR 120 TO 450 DEG F PIPING INSTALLATIONS.
- I. BUILDING ATTACHMENTS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SECTIONS, INSTALL THE FOLLOWING TYPES:
  1. STEEL OR MALLEABLE CONCRETE INSERTS (MSS TYPE 18): FOR UPPER ATTACHMENT TO SUSPEND PIPE HANGERS FROM CONCRETE CEILING.
  2. TOP-BEAM C-CLAMPS (MSS TYPE 19): FOR USE UNDER ROOF INSTALLATIONS WITH BAR-JOIST CONSTRUCTION TO ATTACH TO TOP FLANGE OF STRUCTURAL SHAPE.
  3. SIDE-BEAM OR CHANNEL CLAMPS (MSS TYPE 20): FOR ATTACHING TO BOTTOM FLANGE OF BEAMS, CHANNELS, OR ANGLES.
  4. CENTER-BEAM CLAMPS (MSS TYPE 21): FOR ATTACHING TO CENTER OF BOTTOM FLANGE OF BEAMS.
  5. WELDED BEAM ATTACHMENTS (MSS TYPE 22): FOR ATTACHING TO BOTTOM OF BEAMS IF LOADS ARE CONSIDERABLE AND ROD SIZES ARE LARGE.
  6. C-CLAMPS (MSS TYPE 23): FOR STRUCTURAL SHAPES.
  7. WELDED-STEEL BRACKETS: FOR SUPPORT OF PIPES FROM BELOW, OR FOR SUSPENDING FROM ABOVE BY USING CLIP AND ROD. USE ONE OF THE FOLLOWING FOR INDICATED LOADS:
     - a. LIGHT (MSS TYPE 31): 750 LB.
     - b. MEDIUM (MSS TYPE 32): 1500 LB.
     - c. HEAVY (MSS TYPE 33): 3000 LB.
  8. SIDE-BEAM BRACKETS (MSS TYPE 34): FOR SIDES OF STEEL OR WOODEN BEAMS.
  9. PLATE LUGS (MSS TYPE 57): FOR ATTACHING TO STEEL BEAMS IF FLEXIBILITY AT BEAM IS REQUIRED.
- J. SADDLES AND SHIELDS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SECTIONS, INSTALL THE FOLLOWING TYPES:
  1. STEEL PIPE-COVERING PROTECTION SADDLES (MSS TYPE 39): TO FILL INTERIOR VOIDS WITH INSULATION THAT MATCHES ADJOINING INSULATION.
  2. PROTECTION SHIELDS (MSS TYPE 40): OF LENGTH RECOMMENDED IN WRITING BY MANUFACTURER TO PREVENT CRUSHING INSULATION.
  3. THERMAL-HANGER SHIELD INSERTS: FOR SUPPORTING INSULATED PIPE.
- K. SPRING HANGERS AND SUPPORTS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SECTIONS, INSTALL THE FOLLOWING TYPES:
  4. SPRING CUSHIONS (MSS TYPE 48): FOR LIGHT LOADS IF VERTICAL MOVEMENT DOES NOT EXCEED 1-1/4 INCHES.
  5. SPRING-CUSHION ROLL HANGERS (MSS TYPE 49): FOR EQUIPPING TYPE 41 ROLL HANGER WITH SPRINGS.
  6. VARIABLE-SPRING BASE SUPPORTS (MSS TYPE 52): PRESET TO INDICATED LOAD AND LIMIT VARIABILITY FACTOR TO 25 PERCENT TO ABSORB EXPANSION AND CONTRACTION OF PIPING SYSTEM FROM BASE SUPPORT.
- L. COMPLY WITH MSS SP-69 FOR TRAPEZE PIPE HANGER SELECTIONS AND APPLICATIONS THAT ARE NOT SPECIFIED IN PIPING SYSTEM SECTIONS.
- M. COMPLY WITH MFMA-102 FOR METAL FRAMING SYSTEM SELECTIONS AND APPLICATIONS THAT ARE NOT SPECIFIED IN PIPING SYSTEM SECTIONS.
- N. USE MECHANICAL-EXPANSION ANCHORS INSTEAD OF BUILDING ATTACHMENTS WHERE REQUIRED IN CONCRETE CONSTRUCTION.

3.2 HANGER AND SUPPORT INSTALLATION
- A. STEEL PIPE HANGER INSTALLATION: COMPLY WITH MSS SP-69 AND MSS SP-89. INSTALL HANGERS, SUPPORTS, CLAMPS, AND ATTACHMENTS AS REQUIRED TO PROPERLY SUPPORT PIPING FROM BUILDING STRUCTURE.
- B. TRAPEZE PIPE HANGER INSTALLATION: COMPLY WITH MSS SP-69 AND MSS SP-89. ARRANGE FOR GROUPING OF PARALLEL RUNS OF HORIZONTAL PIPING AND SUPPORT TOGETHER ON FIELD-FABRICATED TRAPEZE PIPE HANGERS.
  4. PIPES OF VARIOUS SIZES: SUPPORT TOGETHER AND SPACE TRAPEZES FOR SMALLEST PIPE SIZE OR INSTALL INTERMEDIATE SUPPORTS FOR SMALLER DIAMETER PIPES AS SPECIFIED ABOVE FOR INDIVIDUAL PIPE HANGERS.
  5. FOR SMALLER DIAMETER PIPES AS SPECIFIED ABOVE FOR INDIVIDUAL PIPE HANGERS.
  6. FIELD FABRICATE FROM ASTM A 36/A 36M, STEEL SHAPES SELECTED FOR LOADS BEING SUPPORTED. WELD STEEL ACCORDING TO AWS D1.1.
- C. METAL FRAMING SYSTEM INSTALLATION: ARRANGE FOR GROUPING OF PARALLEL RUNS OF PIPING AND SUPPORT TOGETHER ON FIELD-ASSEMBLED METAL FRAMING SYSTEMS.
- D. THERMAL-HANGER SHIELD INSTALLATION: INSTALL IN PIPE HANGER OR SHIELD FOR INSULATED PIPING.
- E. FASTENER SYSTEM INSTALLATION:
  1. INSTALL MECHANICAL-EXPANSION ANCHORS IN CONCRETE AFTER CONCRETE IS PLACED AND COMPLETELY CURED. INSTALL FASTENERS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.
- F. INSTALL HANGERS AND SUPPORTS COMPLETE WITH NECESSARY INSERTS, BOLTS, RODS, NUTS, WASHERS, AND OTHER ACCESSORIES.
- G. EQUIPMENT SUPPORT INSTALLATION: FABRICATE FROM WELDED-STRUCTURAL-STEEL SHAPES.
- H. INSTALL HANGERS AND SUPPORTS TO ALLOW CONTROLLED THERMAL AND SEISMIC MOVEMENT OF PIPING SYSTEMS, TO PERMIT FREEDOM OF MOVEMENT BETWEEN PIPE ANCHORS, AND TO FACILITATE ACTION OF EXPANSION JOINTS, EXPANSION LOOPS, EXPANSION BENDS, AND SIMILAR UNITS.
- I. INSTALL LATERAL BRACING WITH PIPE HANGERS AND SUPPORTS TO PREVENT SWAYING.
- J. INSTALL BUILDING ATTACHMENTS WITHIN CONCRETE SLABS OR ATTACH TO STRUCTURAL STEEL. INSTALL ADDITIONAL ATTACHMENTS AT CONCENTRATED LOADS, INCLUDING VALVES, FLANGES, AND STRAINERS, NPS 2-1/2 AND LARGER AND AT CHANGES IN DIRECTION OF INSTALL CONCRETE INSERTS BEFORE CONCRETE IS PLACED; FASTEN INSERTS TO FORMS AND INSTALL REINFORCING BARS THROUGH OPENINGS AT TOP OF INSERTS.
- K. LOAD DISTRIBUTION: INSTALL HANGERS AND SUPPORTS SO PIPING LIVE AND DEAD LOADS AND STRESSES FROM MOVEMENT WILL NOT BE TRANSMITTED TO CONNECTED EQUIPMENT.
- L. PIPE SLOPES: INSTALL HANGERS AND SUPPORTS TO PROVIDE INDICATED PIPE SLOPES AND SO MAXIMUM PIPE DEFLECTIONS ALLOWED BY ASME B31.9 (FOR BUILDING SERVICES PIPING) ARE NOT EXCEEDED.
- M. INSULATED PIPING: COMPLY WITH THE FOLLOWING:
  1. ATTACH CLAMPS AND SPACERS TO PIPING.
     - a. PIPING OPERATING ABOVE AMBIENT AIR TEMPERATURE: CLAMP MAY PROJECT THROUGH INSULATION.
     - b. PIPING OPERATING BELOW AMBIENT AIR TEMPERATURE: USE THERMAL-HANGER SHIELD INSERT WITH CLAMP SIZED TO MATCH OD OF INSERT.
     - c. DO NOT EXCEED PIPE STRESS LIMITS ACCORDING TO ASME B31.9 FOR BUILDING SERVICES PIPING.
  2. INSTALL MSS SP-58, TYPE 39, PROTECTION SADDLES IF INSULATION WITHOUT VAPOR BARRIER IS INDICATED. FILL INTERIOR VOIDS WITH INSULATION THAT MATCHES ADJOINING INSULATION.
  3. INSTALL MSS SP-58, TYPE 40, PROTECTIVE SHIELDS ON COLD PIPING WITH VAPOR BARRIER. SHIELDS SHALL SPAN AN ARC OF 180 DEGREES.
  4. SHIELD DIMENSIONS FOR PIPE: NOT LESS THAN THE FOLLOWING:
     - a. NPS 1/4 TO NPS 3-1/2: 12 INCHES LONG AND 0.048 INCH THICK.
     - b. NPS 4: 12 INCHES LONG AND 0.06 INCH THICK.
     - c. NPS 5 AND NPS 6: 18 INCHES LONG AND 0.06 INCH THICK.
     - d. NPS 8 TO NPS 14: 24 INCHES LONG AND 0.075 INCH THICK.
     - e. NPS 16 TO NPS 24: 24 INCHES LONG AND 0.105 INCH THICK.
  5. PIPES NPS 8 AND LARGER: INCLUDE WOOD INSERTS.
  6. INSERT MATERIAL: LENGTH AT LEAST AS LONG AS PROTECTIVE SHIELD.
  7. THERMAL-HANGER SHIELDS: INSTALL WITH INSULATION SAME THICKNESS AS PIPING INSULATION.

3.3 EQUIPMENT SUPPORTS
- A. FABRICATE STRUCTURAL-STEEL STANDS TO SUSPEND EQUIPMENT FROM STRUCTURE OVERHEAD OR TO SUPPORT EQUIPMENT ABOVE FLOOR.
- B. GROUTING: PLACE GROUT UNDER SUPPORTS FOR EQUIPMENT AND MAKE SMOOTH BEARING SURFACE.
- C. PROVIDE LATERAL BRACING, TO PREVENT SWAYING, FOR EQUIPMENT SUPPORTS.

3.4 METAL FABRICATIONS
- A. CUT, DRILL, AND FIT MISCELLANEOUS METAL FABRICATIONS FOR TRAPEZE PIPE HANGERS AND EQUIPMENT SUPPORTS.
- B. FIT EXPOSED CONNECTIONS TOGETHER TO FORM HAIRLINE JOINTS. FIELD WELD CONNECTIONS THAT CANNOT BE SHOP WELDED BECAUSE OF SHIPPING SIZE LIMITATIONS.
- C. FIELD WELDING: COMPLY WITH AWS D1.1 PROCEDURES FOR SHIELDED METAL ARC WELDING, APPEARANCE AND QUALITY OF WELDS, AND METHODS USED IN CORRECTING WELDING WORK, AND WITH THE FOLLOWING:
  1. USE MATERIALS AND METHODS THAT MINIMIZE DISTORTION AND DEVELOP STRENGTH AND CORROSION RESISTANCE OF BASE METALS.
  2. OBTAIN FUSION WITHOUT UNDERCUT OR OVERLAP.
  3. REMOVE WELDING FLUX IMMEDIATELY.
  4. FINISH WELDS AT EXPOSED CONNECTIONS SO NO ROUGHNESS SHOWS AFTER FINISHING AND CONTOURS OF WELDED SURFACES MATCH ADJACENT CONTOURS.

3.5 ADJUSTING
- A. HANGER ADJUSTMENTS: ADJUST HANGERS TO DISTRIBUTE LOADS EQUALLY ON ATTACHMENTS AND TO ACHIEVE INDICATED SLOPE OF PIPE.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

PLUMBING SPECIFICATIONS

SHEET NO.: P0.02

D. 3.6 PAINTING
A. TOUCH UP: CLEAN FIELD WELDS AND ABRADED AREAS OF SHOP PAINT. PAINT EXPOSED AREAS IMMEDIATELY AFTER ERECTING HANGERS AND SUPPORTS. USE SAME MATERIALS AS USED FOR SHOP PAINTING. COMPLY WITH SSPC–PA 1 REQUIREMENTS FOR TOUCHING UP FIELD–PAINTED SURFACES.
  1. APPLY PAINT BY BRUSH OR SPRAY TO PROVIDE MINIMUM DRY FILM THICKNESS OF 2.0 MILS.
B. GALVANIZED SURFACES: CLEAN WELDS, BOLTED CONNECTIONS, AND ABRADED AREAS AND APPLY GALVANIZING–REPAIR PAINT TO COMPLY WITH ASTM A 780.

SECTION 220700 – PLUMBING INSULATION (SEE SCHEDULE FOR COORDINATION WITH THIS PROJECT)

PART 1 – GENERAL

1.1 SUMMARY
A. SECTION INCLUDES:
  1. INSULATION MATERIALS:
    a. FLEXIBLE ELASTOMERIC.
    b. MINERAL FIBER.
    c. POLYOLEFIN
  2. INSULATING CEMENTS.
  3. ADHESIVES.
  4. MASTICS.
  5. SEALANTS.
  6. FACTORY–APPLIED JACKETS.
  7. FIELD–APPLIED FABRIC–REINFORCING MESH.
  8. FIELD–APPLIED JACKETS.
  9. TAPES.
  10. SECUREMENTS.
  11. CORNER ANGLES.

1.2 SUBMITTALS
A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT INDICATED.
B. SHOP DRAWINGS:
  1. DETAIL APPLICATION OF PROTECTIVE SHIELDS, SADDLES, AND INSERTS AT HANGERS FOR EACH TYPE OF INSULATION AND HANGER.
  2. DETAIL ATTACHMENT AND COVERING OF HEAT TRACING INSIDE INSULATION.
  3. DETAIL INSULATION APPLICATION AT PIPE EXPANSION JOINTS FOR EACH TYPE OF INSULATION.
  4. DETAIL INSULATION APPLICATION AT ELBOWS, FITTINGS, FLANGES, VALVES, AND SPECIALTIES FOR EACH TYPE OF INSULATION.
  5. DETAIL REMOVABLE INSULATION AT PIPING SPECIALTIES, EQUIPMENT CONNECTIONS, AND ACCESS PANELS.
  6. DETAIL APPLICATION OF FIELD–APPLIED JACKETS.
  7. DETAIL APPLICATION AT LINKAGES OF CONTROL DEVICES.
  8. DETAIL FIELD APPLICATION FOR EACH EQUIPMENT TYPE.
C. FIELD QUALITY–CONTROL REPORTS.

1.3 QUALITY ASSURANCE
A. FIRE–TEST–RESPONSE CHARACTERISTICS: INSULATION AND RELATED MATERIALS SHALL HAVE FIRE–TEST–RESPONSE CHARACTERISTICS INDICATED, AS DETERMINED BY TESTING IDENTICAL PRODUCTS PER ASTM E 84, BY A TESTING AND INSPECTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION. FACTORY LABEL INSULATION AND JACKET MATERIALS AND ADHESIVE, MASTIC, TAPES, AND CEMENT MATERIAL CONTAINERS, WITH APPROPRIATE MARKINGS OF APPLICABLE TESTING AND INSPECTING AGENCY.
  1. INSULATION INSTALLED INDOORS: FLAME–SPREAD INDEX OF 25 OR LESS, AND SMOKE–DEVELOPED INDEX OF 50 OR LESS.
  2. INSULATION INSTALLED OUTDOORS: FLAME–SPREAD INDEX OF 75 OR LESS, AND SMOKE–DEVELOPED INDEX OF 150 OR LESS.

PART 2 – PRODUCTS

2.1 INSULATION MATERIALS
A. COMPLY WITH SCHEDULED REQUIREMENTS ILLUSTRATED ON THE DRAWINGS FOR WHERE INSULATING MATERIALS SHALL BE APPLIED.
B. PRODUCTS SHALL NOT CONTAIN ASBESTOS, LEAD, MERCURY, OR MERCURY COMPOUNDS.
C. PRODUCTS THAT COME IN CONTACT WITH STAINLESS STEEL SHALL HAVE A LEACHABLE CHLORIDE CONTENT OF LESS THAN 50 PPM WHEN TESTED ACCORDING TO ASTM C 871.
D. INSULATION MATERIALS FOR USE ON AUSTENITIC STAINLESS STEEL SHALL BE QUALIFIED AS ACCEPTABLE ACCORDING TO ASTM C 795.
E. FOAM INSULATION MATERIALS SHALL NOT USE CFC OR HCFC BLOWING AGENTS IN THE MANUFACTURING PROCESS.
F. FLEXIBLE ELASTOMERIC: CLOSED–CELL, SPONGE– OR EXPANDED–RUBBER MATERIALS. COMPLY WITH ASTM C 534, TYPE I FOR TUBULAR MATERIALS AND TYPE II FOR SHEET MATERIALS.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. AEROFLEX USA INC.; AEROCEL.
    b. ARMACELL LLC; AP ARMAFLEX.
    c. RBX CORPORATION; INSUL–SHEET 1800 AND INSUL–TUBE 180.
G. HIGH–TEMPERATURE, MINERAL–FIBER BLANKET INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 553, TYPE V, WITHOUT FACTORY–APPLIED JACKET.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. JOHNS MANVILLE; HTB 23 SPIN–GLAS.
    b. OWENS CORNING; HIGH TEMPERATURE FLEXIBLE BATT INSULATIONS.
H. HIGH–TEMPERATURE, MINERAL–FIBER BOARD INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 612, TYPE III, WITHOUT FACTORY–APPLIED JACKET.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. JOHNS MANVILLE; 1000 SERIES SPIN–GLAS.
    b. OWENS CORNING; HIGH TEMPERATURE INDUSTRIAL BOARD INSULATIONS.
    c. ROCK WOOL MANUFACTURING COMPANY; DELTA BOARD.
I. MINERAL–FIBER, PREFORMED PIPE INSULATION:
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. JOHNS MANVILLE; MICRO–LOK.
    b. KNAUF INSULATION; 1000 PIPE INSULATION.
    c. OWENS CORNING; FIBERGLAS PIPE INSULATION.
  2. TYPE I, 850 DEG F MATERIALS: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 547,
  3. TYPE I, GRADE A, WITH FACTORY–APPLIED ASJ–SSL. FACTORY–APPLIED JACKET REQUIREMENTS ARE SPECIFIED IN "FACTORY–APPLIED JACKETS" ARTICLE.
J. MINERAL–FIBER, PIPE AND TANK INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. SEMIRIGID BOARD MATERIAL WITH FACTORY–APPLIED ASJ COMPLYING WITH ASTM C 1393, TYPE II OR TYPE IIIA CATEGORY 2, OR WITH PROPERTIES SIMILAR TO ASTM C 612, TYPE IB. NOMINAL DENSITY IS 2.5 LB/CU. FT. OR MORE. THERMAL CONDUCTIVITY (K–VALUE) AT 100 DEG F IS 0.29 BTU X IN./H X SQ. FT. X DEG F OR LESS. FACTORY–APPLIED JACKET REQUIREMENTS ARE SPECIFIED IN "FACTORY–APPLIED JACKETS" ARTICLE.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CERTAINTEED CORP.; CRIMPWRAP.
    b. JOHNS MANVILLE; MICROFLEX.
    c. KNAUF INSULATION; PIPE AND TANK INSULATION.
    d. OWENS CORNING; FIBERGLAS PIPE AND TANK INSULATION.
K. POLYOLEFIN: UNICELLULAR, POLYETHYLENE THERMAL PLASTIC INSULATION. COMPLY WITH ASTM C 534 OR ASTM C 1427, TYPE I, GRADE 1 FOR TUBULAR MATERIALS AND TYPE II, GRADE 1 FOR SHEET MATERIALS.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. ARMACELL LLC; TUBOLIT.
    b. NOMACO INC.; IMCOLOCK, IMCOSHEET, NOMALOCK, AND NOMAPLY.
    c. RBX CORPORATION; THERMA–CELL.

2.2 INSULATING CEMENTS
A. MINERAL–FIBER, HYDRAULIC–SETTING INSULATING AND FINISHING CEMENT: COMPLY WITH ASTM C 449/C 449M.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. INSULCO, DIVISION OF MFS, INC.; SMOOTHKOTE.
    b. INSULATION MFG. CO., INC.; PK NO. 127, AND QUIK–COTE.
    c. ROCK WOOL MANUFACTURING COMPANY; DELTA ONE SHOT.

2.3 ADHESIVES
A. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES AND FOR BONDING INSULATION TO ITSELF AND TO SURFACES TO BE INSULATED, UNLESS OTHERWISE INDICATED.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–96.
    b. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; 81–33.
B. FLEXIBLE ELASTOMERIC AND POLYOLEFIN ADHESIVE: COMPLY WITH MIL–A–24179A, TYPE II, CLASS I.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. AEROFLEX USA INC.; AEROSEAL.
    b. ARMACELL LCC; 520 ADHESIVE.
    c. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY.
    d. RBX CORPORATION; RUBATEX CONTACT ADHESIVE.

C. MINERAL–FIBER ADHESIVE: COMPLY WITH MIL–A–3316C, CLASS 2, GRADE A.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–82.
    b. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; 85–20.
    c. ITW TACC, DIVISION OF ILLINOIS TOOL WORKS; S–90/80.
D. ASJ ADHESIVE, AND FSK AND PVDC JACKET ADHESIVE: COMPLY WITH MIL–A–3316C, CLASS 2, GRADE A FOR BONDING INSULATION JACKET LAP SEAMS AND JOINTS.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–82.
    b. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; 85–20.
E. PVC JACKET ADHESIVE: COMPATIBLE WITH PVC JACKET.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. DOW CHEMICAL COMPANY (THE); 739, DOW SILICONE.
    b. JOHNS–MANVILLE; ZESTON PERMA–WELD, CEEL–TITE SOLVENT WELDING ADHESIVE.
    c. SPEEDLINE CORPORATION; SPEEDLINE VINYL ADHESIVE.

2.4 MASTICS
A. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES; COMPLY WITH MIL–C–19565C, TYPE II.
B. VAPOR–BARRIER MASTIC: WATER BASED; SUITABLE FOR INDOOR AND OUTDOOR USE ON BELOW AMBIENT SERVICES.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–35.
    b. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; 30–90.
    c. MARATHON INDUSTRIES, INC.; 590.
  2. WATER–VAPOR PERMEANCE: ASTM E 96, PROCEDURE B, 0.013 PERM AT 43–MIL DRY FILM THICKNESS.
  3. SERVICE TEMPERATURE RANGE: MINUS 20 TO PLUS 180 DEG F.
  4. SOLIDS CONTENT: ASTM D 1644, 59 PERCENT BY VOLUME AND 71 PERCENT BY WEIGHT.
  5. COLOR: WHITE.

2.5 SEALANTS
A. JOINT SEALANTS:
  1. JOINT SEALANTS FOR POLYSTYRENE PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–70.
    b. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; 30–45/30–46.
    c. MARATHON INDUSTRIES, INC.; 405.
  2. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES.

PERMANENTLY FLEXIBLE, ELASTOMERIC SEALANT.
  1. SERVICE TEMPERATURE RANGE: MINUS 100 TO PLUS 300 DEG F.
  2. COLOR: WHITE OR GRAY.
B. FSK AND METAL JACKET FLASHING SEALANTS:
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–76–8.
    b. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; 95–44.
    c. MARATHON INDUSTRIES, INC.; 405.
  2. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES.
  3. FIRE– AND WATER–RESISTANT, FLEXIBLE, ELASTOMERIC SEALANT.
  4. SERVICE TEMPERATURE RANGE: MINUS 40 TO PLUS 250 DEG F.
  5. COLOR: ALUMINUM.
C. ASJ FLASHING SEALANTS, AND VINYL, PVDC, AND PVC JACKET FLASHING SEALANTS:
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; CP–76.
  1. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES.
  2. FIRE– AND WATER–RESISTANT, FLEXIBLE, ELASTOMERIC SEALANT.
  3. SERVICE TEMPERATURE RANGE: MINUS 40 TO PLUS 250 DEG F.
  4. COLOR: WHITE.

2.6 FACTORY–APPLIED JACKETS
A. INSULATION SYSTEM SCHEDULES INDICATE FACTORY–APPLIED JACKETS ON VARIOUS APPLICATIONS. WHEN FACTORY–APPLIED JACKETS ARE INDICATED, COMPLY WITH THE FOLLOWING:
  1. ASJ: WHITE, KRAFT–PAPER, FIBERGLASS–REINFORCED SCRIM WITH ALUMINUM–FOIL BACKING; COMPLYING WITH ASTM C 1136, TYPE I.
  2. ASJ–SSL: ASJ WITH SELF–SEALING, PRESSURE–SENSITIVE, ACRYLIC–BASED ADHESIVE COVERED BY A REMOVABLE PROTECTIVE STRIP; COMPLYING WITH ASTM C 1136, TYPE I.
  3. FSK JACKET: ALUMINUM–FOIL, FIBERGLASS–REINFORCED SCRIM WITH KRAFT–PAPER BACKING; COMPLYING WITH ASTM C 1136, TYPE II.

2.7 FIELD–APPLIED FABRIC–REINFORCING MESH
A. WOVEN POLYESTER FABRIC: APPROXIMATELY 1 OZ./SQ. YD. WITH A THREAD COUNT OF 10 STRANDS BY 10 STRANDS/SQ. INCH, IN A LENO WEAVE, FOR EQUIPMENT AND PIPE.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. FOSTER PRODUCTS CORPORATION, H. B. FULLER COMPANY; MAST–A–FAB.
    b. VIMASCO CORPORATION; ELASTAFAB 894.

2.8 FIELD–APPLIED JACKETS
A. FIELD–APPLIED JACKETS SHALL COMPLY WITH ASTM C 921, TYPE I, UNLESS OTHERWISE INDICATED.
B. PVC JACKET: HIGH–IMPACT–RESISTANT, UV–RESISTANT PVC COMPLYING WITH ASTM D 1784, CLASS 16354–C; THICKNESS AS SCHEDULED; ROLL STOCK READY FOR SHOP OR FIELD CUTTING AND FORMING. THICKNESS IS INDICATED IN FIELD–APPLIED JACKET SCHEDULES.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. JOHNS MANVILLE; ZESTON.
    b. PLASTICS, INC.; FG SERIES.
    c. PROTO PVC CORPORATION; LOSMOKE.
    d. SPEEDLINE CORPORATION; SMOKESAFE.
  2. ADHESIVE: AS RECOMMENDED BY JACKET MATERIAL MANUFACTURER.
  3. COLOR: WHITE.
  4. FACTORY–FABRICATED FITTING COVERS TO MATCH JACKET IF AVAILABLE; OTHERWISE, FIELD FABRICATE.
    a. 45– AND 90–DEGREE, SHORT– AND LONG–RADIUS ELBOWS, TEES, VALVES, FLANGES, UNIONS, REDUCERS, END CAPS, SOIL–PIPE HUBS, TRAPS, MECHANICAL JOINTS, AND P–TRAP AND SUPPLY COVERS FOR LAVATORIES.
  5. FACTORY–FABRICATED TANK HEADS AND TANK SIDE PANELS.
C. ALUMINUM JACKET: COMPLY WITH ASTM B 209, ALLOY 3003, 3005, 3105 OR 5005, TEMPER H–14.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS, DIVISION OF ITW; METAL JACKETING SYSTEMS.
    b. PABCO METALS CORPORATION; SUREFIT.
    c. RPR PRODUCTS, INC.; INSUL–MATE.
  2. SHEET AND ROLL STOCK READY FOR SHOP OR FIELD SIZING OR FACTORY CUT AND ROLLED TO SIZE.
  3. FINISH AND THICKNESS ARE INDICATED IN FIELD–APPLIED JACKET SCHEDULES.
  4. MOISTURE BARRIER FOR INDOOR APPLICATIONS: 1–MIL– THICK, HEAT–BONDED POLYETHYLENE AND KRAFT PAPER.
  5. MOISTURE BARRIER FOR OUTDOOR APPLICATIONS: 2.5–MIL– THICK POLYSURLYN.
  6. FACTORY–FABRICATED FITTING COVERS:
    a. SAME MATERIAL, FINISH, AND THICKNESS AS JACKET.
    b. PREFORMED 2–PIECE OR GORE, 45– AND 90–DEGREE, SHORT– AND LONG–RADIUS ELBOWS.
    c. TEE COVERS.
    d. FLANGE AND UNION COVERS.
    e. END CAPS.
    f. BEVELED COLLARS.
    g. VALVE COVERS.
    h. FIELD FABRICATE FITTING COVERS ONLY IF FACTORY–FABRICATED FITTING COVERS ARE NOT AVAILABLE.

2.9 TAPES
A. ASJ TAPE: WHITE VAPOR–RETARDER TAPE MATCHING FACTORY–APPLIED JACKET WITH ACRYLIC ADHESIVE, COMPLYING WITH ASTM C 1136.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. AVERY DENNISON CORPORATION, SPECIALTY TAPES DIVISION; FASSON 0835.
    b. COMPAC CORP.; 104 AND 105.
    c. IDEAL TAPE CO., INC., AN AMERICAN BILTRITE COMPANY; 428 AWF ASJ.
    d. VENTURE TAPE; 1540 CW PLUS, 1542 CW PLUS, AND 1542 CW PLUS/SQ.
  2. WIDTH: 3 INCHES.
  3. THICKNESS: 11.5 MILS.
  4. ADHESION: 90 OUNCES FORCE/INCH IN WIDTH.
  5. ELONGATION: 2 PERCENT.
  6. TENSILE STRENGTH: 40 LBF/INCH IN WIDTH.
  7. ASJ TAPE DISKS AND SQUARES: PRECUT DISKS OR SQUARES OF ASJ TAPE.
B. FSK TAPE: FOIL–FACE, VAPOR–RETARDER TAPE MATCHING FACTORY–APPLIED JACKET WITH ACRYLIC ADHESIVE; COMPLYING WITH ASTM C1136.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. AVERY DENNISON CORPORATION, SPECIALTY TAPES DIVISION; FASSON 0827.
    b. COMPAC CORP.; 110 AND 111.
    c. IDEAL TAPE CO., INC., AN AMERICAN BILTRITE COMPANY; 491 AWF FSK.
    d. VENTURE TAPE; 1525 CW, 1528 CW, AND 1528 CW/SQ.
  2. WIDTH: 3 INCHES.
  3. THICKNESS: 6.5 MILS.
  4. ADHESION: 90 OUNCES FORCE/INCH IN WIDTH.
  5. ELONGATION: 2 PERCENT.
  6. TENSILE STRENGTH: 40 LBF/INCH IN WIDTH.
  7. FSK TAPE DISKS AND SQUARES: PRECUT DISKS OR SQUARES OF FSK TAPE.
C. PVC TAPE: WHITE VAPOR–RETARDER TAPE MATCHING FIELD–APPLIED PVC JACKET WITH ACRYLIC ADHESIVE. SUITABLE FOR INDOOR AND OUTDOOR APPLICATIONS.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. AVERY DENNISON CORPORATION, SPECIALTY TAPES DIVISION; FASSON 0555.
    b. COMPAC CORP.; 130.
    c. IDEAL TAPE CO., INC., AN AMERICAN BILTRITE COMPANY; 370 WHITE PVC TAPE.
    d. VENTURE TAPE; 1506 CW NS.
  2. WIDTH: 2 INCHES.
  3. THICKNESS: 6 MILS.
  4. ADHESION: 64 OUNCES FORCE/INCH IN WIDTH.
  5. ELONGATION: 500 PERCENT.
  6. TENSILE STRENGTH: 18 LBF/INCH IN WIDTH.
D. ALUMINUM–FOIL TAPE: VAPOR–RETARDER TAPE WITH ACRYLIC ADHESIVE.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. AVERY DENNISON CORPORATION, SPECIALTY TAPES DIVISION; FASSON 0800.
    b. COMPAC CORP.; 120.
    c. IDEAL TAPE CO., INC., AN AMERICAN BILTRITE COMPANY; 488 AWF.
    d. VENTURE TAPE; 3520 CW.
  2. WIDTH: 2 INCHES.
  3. THICKNESS: 3.7 MILS.
  4. ADHESION: 100 OUNCES FORCE/INCH IN WIDTH.
  5. ELONGATION: 5 PERCENT.
  6. TENSILE STRENGTH: 34 LBF/INCH IN WIDTH.

2.10 SECUREMENTS
A. ALUMINUM BANDS: ASTM B 209, ALLOY 3003, 3005, 3105, OR 5005; TEMPER H–14, 0.020 INCH THICK, 3/4 INCH WIDE WITH WING OR CLOSED SEAL.
  1. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
    a. CHILDERS PRODUCTS; BANDS.
    b. PABCO METALS CORPORATION; BANDS.
    c. RPR PRODUCTS, INC.; BANDS.
B. INSULATION PINS AND HANGERS:
  1. METAL, ADHESIVELY ATTACHED, PERFORATED–BASE INSULATION HANGERS: BASEPLATE WELDED TO PROJECTING SPINDLE THAT IS CAPABLE OF HOLDING INSULATION, OF THICKNESS INDICATED, SECURELY IN POSITION INDICATED WHEN SELF–LOCKING WASHER IS IN COMPLY WITH THE FOLLOWING REQUIREMENTS:
    a. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
      • AGM INDUSTRIES, INC.; TACTOO INSUL–HANGERS, SERIES T.
      • GEMCO; PERFORATED BASE.
      • MIDWEST FASTENERS, INC.; SPINDLE.
    b. BASEPLATE: PERFORATED, GALVANIZED CARBON–STEEL SHEET, 0.030 INCH THICK BY 2 INCHES SQUARE.
    c. SPINDLE: STAINLESS STEEL, FULLY ANNEALED, 0.106–INCH– DIAMETER SHANK, LENGTH TO SUIT DEPTH OF INSULATION INDICATED.
    d. ADHESIVE: RECOMMENDED BY HANGER MANUFACTURER. PRODUCT WITH DEMONSTRATED CAPABILITY TO BOND INSULATION HANGER SECURELY TO SUBSTRATES INDICATED WITHOUT DAMAGING INSULATION, HANGERS, AND SUBSTRATES.
  2. NONMETAL, ADHESIVELY ATTACHED, PERFORATED–BASE INSULATION HANGERS: BASEPLATE FASTENED TO PROJECTING SPINDLE THAT IS CAPABLE OF HOLDING INSULATION, OF THICKNESS INDICATED, SECURELY IN POSITION INDICATED WHEN SELF–LOCKING WASHER IS IN COMPLY WITH THE FOLLOWING REQUIREMENTS:
    a. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
      • GEMCO; NYLON HANGERS.
      • MIDWEST FASTENERS, INC.; NYLON INSULATION HANGERS.
    b. BASEPLATE: PERFORATED, NYLON SHEET, 0.030 INCH THICK BY 1–1/2 INCHES IN DIAMETER.
    c. SPINDLE: NYLON, 0.106–INCH– DIAMETER SHANK, LENGTH TO SUIT DEPTH OF INSULATION INDICATED, UP TO 2–1/2 INCHES.
    d. ADHESIVE: RECOMMENDED BY HANGER MANUFACTURER. PRODUCT WITH DEMONSTRATED CAPABILITY TO BOND INSULATION HANGER SECURELY TO SUBSTRATES INDICATED WITHOUT DAMAGING INSULATION, HANGERS, AND SUBSTRATES.
  3. INSULATION–RETAINING WASHERS: SELF–LOCKING WASHERS FORMED FROM 0.016–INCH– THICK, STAINLESS–STEEL SHEET, WITH BEVELED EDGE SIZED AS REQUIRED TO HOLD INSULATION SECURELY IN PLACE BUT NOT LESS THAN 1–1/2 INCHES IN DIAMETER.
    a. PRODUCTS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ONE OF THE FOLLOWING:
      • AGM INDUSTRIES, INC.; RC–150.
      • GEMCO; R–150.
      • MIDWEST FASTENERS, INC.; WA–150.
      • NELSON STUD WELDING; SPEED CLIPS.
    b. PROTECT ENDS WITH CAPPED SELF–LOCKING WASHERS INCORPORATING A SPRING STEEL INSERT TO ENSURE PERMANENT RETENTION OF CAP IN EXPOSED LOCATIONS.

C. STAPLES: OUTWARD–CLINCHING INSULATION STAPLES, NOMINAL 3/4–INCH– WIDE, STAINLESS STEEL OR MONEL.
D. WIRE: 0.062–INCH SOFT–ANNEALED, STAINLESS STEEL.
  1. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
    a. C & F WIRE.
    b. CHILDERS PRODUCTS.
    c. RPR PRODUCTS, INC.

2.11 CORNER ANGLES
A. PVC CORNER ANGLES: 30 MILS THICK, MINIMUM 1 BY 1 INCH, PVC ACCORDING TO ASTM D 1784, CLASS 16354–C. WHITE OR COLOR–CODED TO MATCH ADJACENT SURFACE.
B. ALUMINUM CORNER ANGLES: 0.040 INCH THICK, MINIMUM 1 BY 1 INCH, ALUMINUM ACCORDING TO ASTM B 209, ALLOY 3003, 3005, 3105 OR 5005; TEMPER H–14.

PART 3 – EXECUTION

3.1 PREPARATION
A. SURFACE PREPARATION: CLEAN AND DRY SURFACES TO RECEIVE INSULATION. REMOVE MATERIALS THAT WILL ADVERSELY AFFECT INSULATION APPLICATION.
B. COORDINATE INSULATION INSTALLATION WITH THE TRADE INSTALLING HEAT TRACING. COMPLY WITH REQUIREMENTS FOR HEAT TRACING THAT APPLY TO INSULATION.
C. MIX INSULATING CEMENTS WITH CLEAN POTABLE WATER; IF INSULATING CEMENTS ARE TO BE IN CONTACT WITH STAINLESS–STEEL SURFACES, USE DEMINERALIZED WATER.

3.2 GENERAL INSTALLATION REQUIREMENTS
A. INSTALL INSULATION MATERIALS, ACCESSORIES, AND FINISHES WITH SMOOTH, STRAIGHT, AND EVEN SURFACES; FREE OF VOIDS THROUGHOUT THE LENGTH OF EQUIPMENT AND PIPING INCLUDING FITTINGS, VALVES, AND SPECIALTIES.
B. INSTALL INSULATION MATERIALS, FORMS, VAPOR BARRIERS OR RETARDERS, JACKETS, AND THICKNESSES REQUIRED FOR EACH ITEM OF EQUIPMENT AND PIPE SYSTEM AS SPECIFIED IN INSULATION SYSTEM SCHEDULES.
C. INSTALL ACCESSORIES COMPATIBLE WITH INSULATION MATERIALS AND SUITABLE FOR THE SERVICE. INSTALL ACCESSORIES THAT DO NOT CORRODE, SOFTEN, OR OTHERWISE ATTACK INSULATION OR JACKET IN EITHER WET OR DRY STATE.
D. INSTALL INSULATION WITH LONGITUDINAL SEAMS AT TOP AND BOTTOM OF HORIZONTAL RUNS.
E. INSTALL MULTIPLE LAYERS OF INSULATION WITH LONGITUDINAL AND END SEAMS STAGGERED.
F. DO NOT WELD BRACKETS, CLIPS, OR OTHER ATTACHMENT DEVICES TO PIPING, FITTINGS, AND SPECIALTIES.
G. KEEP INSULATION MATERIALS DRY DURING APPLICATION AND FINISHING.
H. INSTALL INSULATION WITH TIGHT LONGITUDINAL SEAMS AND END JOINTS. BOND SEAMS AND JOINTS WITH ADHESIVE RECOMMENDED BY INSULATION MATERIAL MANUFACTURER.
I. INSTALL INSULATION WITH LEAST NUMBER OF JOINTS PRACTICAL.
J. WHERE VAPOR BARRIER IS INDICATED, SEAL JOINTS, SEAMS, AND PENETRATIONS IN INSULATION AT HANGERS, SUPPORTS, ANCHORS, AND OTHER PROJECTIONS WITH VAPOR–BARRIER MASTIC.
  1. INSTALL INSULATION CONTINUOUSLY THROUGH HANGERS AND AROUND ANCHOR ATTACHMENTS.
  2. FOR INSULATION APPLICATION WHERE VAPOR BARRIERS ARE INDICATED, EXTEND INSULATION ON ANCHOR LEGS FROM POINT OF ATTACHMENT TO SUPPORTED ITEM TO POINT OF ATTACHMENT TO STRUCTURE. TAPER AND SEAL ENDS AT ATTACHMENT TO STRUCTURE WITH VAPOR–BARRIER MASTIC.
  3. INSTALL INSERT MATERIALS AND INSTALL INSULATION TO TIGHTLY JOIN THE INSERT. SEAL INSULATION TO INSULATION INSERTS WITH ADHESIVE OR SEALING COMPOUND RECOMMENDED BY INSULATION MATERIAL MANUFACTURER.
  4. COVER INSERTS WITH JACKET MATERIAL MATCHING ADJACENT PIPE INSULATION. INSTALL SHIELDS OVER JACKET, ARRANGED TO PROTECT JACKET FROM TEAR OR PUNCTURE BY HANGER, SUPPORT, AND SHIELD.
K. APPLY ADHESIVES, MASTICS, AND SEALANTS AT MANUFACTURER'S RECOMMENDED COVERAGE RATE AND WET AND DRY FILM THICKNESSES.
L. INSTALL INSULATION WITH FACTORY–APPLIED JACKETS AS FOLLOWS:
  1. DRAW JACKET TIGHT AND SMOOTH.
  2. COVER CIRCUMFERENTIAL JOINTS WITH 3–INCH– WIDE STRIPS, OF SAME MATERIAL AS INSULATION JACKET. SECURE STRIPS WITH ADHESIVE AND OUTWARD CLINCHING STAPLES ALONG BOTH EDGES OF STRIP, SPACED 4 INCHES O.C.
  3. OVERLAP JACKET LONGITUDINAL SEAMS AT LEAST 1–1/2 INCHES. INSTALL INSULATION WITH LONGITUDINAL SEAMS AT BOTTOM OF PIPE. CLEAN AND DRY SURFACE TO RECEIVE SELF–SEALING LAP. STAPLE LAPS WITH OUTWARD CLINCHING STAPLES ALONG EDGE AT 4 INCHES O.C. (WHERE STAPLES ARE USED.)
A. FOR BELOW AMBIENT SERVICES, APPLY VAPOR–BARRIER MASTIC OVER STAPLES.
  4. COVER JOINTS AND SEAMS WITH TAPE AS RECOMMENDED BY INSULATION MATERIAL MANUFACTURER TO MAINTAIN VAPOR SEAL.
  5. WHERE VAPOR BARRIERS ARE INDICATED, APPLY VAPOR–BARRIER MASTIC ON SEAMS AND JOINTS AND AT ENDS ADJACENT TO PIPE FLANGES AND FITTINGS.
M. CUT INSULATION IN A MANNER TO AVOID COMPRESSING INSULATION MORE THAN 75 PERCENT OF ITS NOMINAL THICKNESS.
N. FINISH INSTALLATION WITH SYSTEMS AT OPERATING CONDITIONS. REPAIR JOINT SEPARATIONS AND CRACKING DUE TO THERMAL MOVEMENT.
O. REPAIR DAMAGED INSULATION FACINGS BY APPLYING SAME FACING MATERIAL OVER DAMAGED AREAS. EXTEND PATCHES AT LEAST 4 INCHES BEYOND DAMAGED AREAS. ADHERE, STAPLE, AND SEAL PATCHES SIMILAR TO BUTT JOINTS.
P. FOR ABOVE AMBIENT SERVICES, DO NOT INSTALL INSULATION TO THE FOLLOWING:
  1. VIBRATION–CONTROL DEVICES.
  2. TESTING AGENCY LABELS AND STAMPS.
  3. NAMEPLATES AND DATA PLATES.
  4. MANHOLES.
  5. HANDHOLES.
  6. CLEANOUTS.

3.3 PENETRATIONS
A. INSULATION INSTALLATION AT ROOF PENETRATIONS: INSTALL INSULATION CONTINUOUSLY THROUGH ROOF PENETRATIONS.
  1. SEAL PENETRATIONS WITH FLASHING SEALANT.
  2. FOR APPLICATIONS REQUIRING ONLY INDOOR INSULATION, TERMINATE INSULATION ABOVE ROOF SURFACE AND SEAL WITH JOINT SEALANT. FOR APPLICATIONS REQUIRING INDOOR AND OUTDOOR INSULATION, INSTALL INSULATION FOR OUTDOOR APPLICATIONS TIGHTLY JOINED TO INDOOR INSULATION ENDS. SEAL JOINT WITH JOINT SEALANT.
  3. EXTEND JACKET OF OUTDOOR INSULATION OUTSIDE ROOF FLASHING AT LEAST 2 INCHES BELOW TOP OF ROOF FLASHING.
  4. SEAL JACKET TO ROOF FLASHING WITH FLASHING SEALANT.
B. INSULATION INSTALLATION AT ABOVEGROUND EXTERIOR WALL PENETRATIONS: INSTALL INSULATION CONTINUOUSLY THROUGH WALL PENETRATIONS.
  1. SEAL PENETRATIONS WITH FLASHING SEALANT.
  2. FOR APPLICATIONS REQUIRING ONLY INDOOR INSULATION, TERMINATE INSULATION INSIDE WALL SURFACE AND SEAL WITH JOINT SEALANT. FOR APPLICATIONS REQUIRING INDOOR AND OUTDOOR INSULATION, INSTALL INSULATION FOR OUTDOOR APPLICATIONS TIGHTLY JOINED TO INDOOR INSULATION ENDS. SEAL JOINT WITH JOINT SEALANT.
  3. EXTEND JACKET OF OUTDOOR INSULATION OUTSIDE WALL FLASHING AND OVERLAP WALL FLASHING AT LEAST 2 INCHES.
  4. SEAL JACKET TO WALL FLASHING WITH FLASHING SEALANT.
C. INSULATION INSTALLATION AT INTERIOR WALL AND PARTITION PENETRATIONS (THAT ARE NOT FIRE RATED): INSTALL INSULATION CONTINUOUSLY THROUGH WALLS AND PARTITIONS.
D. INSULATION INSTALLATION AT FIRE–RATED WALL AND PARTITION PENETRATIONS: INSTALL INSULATION CONTINUOUSLY THROUGH PENETRATIONS OF FIRE–RATED WALLS AND PARTITIONS.
E. INSULATION INSTALLATION AT FLOOR PENETRATIONS:
  1. PIPE: INSTALL INSULATION CONTINUOUSLY THROUGH FLOOR PENETRATIONS.
  2. SEAL PENETRATIONS THROUGH FIRE–RATED ASSEMBLIES.

3.4 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION
A. MINERAL FIBER, PIPE AND TANK INSULATION INSTALLATION FOR TANKS AND VESSELS: SECURE INSULATION WITH ADHESIVE AND ANCHOR PINS AND SPEED WASHERS.
  1. APPLY ADHESIVES ACCORDING TO MANUFACTURER'S RECOMMENDED COVERAGE RATES PER UNIT AREA, FOR 100 PERCENT COVERAGE OF TANK AND VESSEL SURFACES.
  2. GROOVE AND SCORE INSULATION MATERIALS TO FIT AS CLOSELY AS POSSIBLE TO EQUIPMENT, INCLUDING CONTOURS. BEVEL INSULATION EDGES FOR CYLINDRICAL SURFACES FOR TIGHT JOINTS. STAGGER END JOINTS.
  3. PROTECT EXPOSED CORNERS WITH SECURED CORNER ANGLES.
  4. INSTALL ADHESIVELY ATTACHED OR SELF–STICKING INSULATION HANGERS AND SPEED WASHERS ON SIDES OF TANKS AND VESSELS AS FOLLOWS:
    a. DO NOT WELD ANCHOR PINS TO ASME–LABELED PRESSURE VESSELS.
    b. SELECT INSULATION HANGERS AND ADHESIVE THAT ARE COMPATIBLE WITH SERVICE TEMPERATURE AND WITH SUBSTRATE.
    c. ON TANKS AND VESSELS, MAXIMUM ANCHOR–PIN SPACING IS 3 INCHES FROM INSULATION END JOINTS, AND 16 INCHES O.C. IN BOTH DIRECTIONS.
    d. DO NOT OVERCOMPRESS INSULATION DURING INSTALLATION.
    e. CUT AND MITER INSULATION SEGMENTS TO FIT CURVED SIDES AND DOMED HEADS OF TANKS AND VESSELS.
    f. IMPALE INSULATION OVER ANCHOR PINS AND ATTACH SPEED WASHERS.
    g. CUT EXCESS PORTION OF PINS EXTENDING BEYOND SPEED WASHERS OR BEND PARALLEL WITH INSULATION SURFACE. COVER EXPOSED PINS AND WASHERS WITH TAPE MATCHING INSULATION FACING.
  5. SECURE EACH LAYER OF INSULATION WITH STAINLESS–STEEL OR ALUMINUM BANDS. SELECT BAND MATERIAL COMPATIBLE WITH INSULATION MATERIALS.
  6. WHERE INSULATION HANGERS ON EQUIPMENT AND VESSELS ARE NOT PERMITTED OR PRACTICAL AND WHERE INSULATION SUPPORT RINGS ARE NOT PROVIDED, INSTALL A GIRDLE NETWORK FOR SECURING INSULATION. STRETCH PRESTRESSED AIRCRAFT CABLE AROUND THE DIAMETER OF VESSEL AND MAKE TAUT WITH CLAMPS, TURNBUCKLES, OR BREATHER SPRINGS. PLACE ONE CIRCUMFERENTIAL GIRDLE AROUND EQUIPMENT APPROXIMATELY 6 INCHES FROM EACH END. INSTALL WIRE OR CABLE BETWEEN TWO CIRCUMFERENTIAL GIRDLES 12 INCHES O.C. INSTALL A WIRE RING AROUND EACH END AND AROUND OUTER PERIPHERY OF CENTER OPENINGS, AND STRETCH PRESTRESSED AIRCRAFT CABLE RADIALLY FROM THE WIRE RING TO NEAREST CIRCUMFERENTIAL GIRDLE. INSTALL ADDITIONAL CIRCUMFERENTIAL GIRDLES ALONG THE BODY OF EQUIPMENT OR TANK AT A MINIMUM SPACING OF 48 INCHES O.C. USE THIS NETWORK FOR SECURING INSULATION WITH TIE WIRE OR BANDS.
  7. STAGGER JOINTS BETWEEN INSULATION LAYERS AT LEAST 3 INCHES.
  8. INSTALL INSULATION IN REMOVABLE SEGMENTS ON EQUIPMENT ACCESS DOORS, MANHOLES, HANDHOLES, AND OTHER ELEMENTS THAT REQUIRE FREQUENT REMOVAL FOR SERVICE AND INSPECTION.
  9. BEVEL AND SEAL INSULATION ENDS AROUND MANHOLES, HANDHOLES, ASME STAMPS, AND NAMEPLATES.
  10. FOR EQUIPMENT WITH SURFACE TEMPERATURES BELOW AMBIENT, APPLY MASTIC TO OPEN ENDS, JOINTS, SEAMS, BREAKS, AND PUNCTURES IN INSULATION.
A. FLEXIBLE ELASTOMERIC THERMAL INSULATION INSTALLATION FOR TANKS AND VESSELS: INSTALL INSULATION OVER ENTIRE SURFACE OF TANKS AND VESSELS.
  1. APPLY 100 PERCENT COVERAGE OF ADHESIVE TO SURFACE WITH MANUFACTURER'S RECOMMENDED ADHESIVE.
  2. SEAL LONGITUDINAL SEAMS AND END JOINTS.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

PLUMBING SPECIFICATIONS

SHEET NO.: P0.03

3.5 GENERAL PIPE INSULATION INSTALLATION

A. REQUIREMENTS IN THIS ARTICLE GENERALLY APPLY TO ALL INSULATION MATERIALS EXCEPT WHERE MORE SPECIFIC REQUIREMENTS ARE SPECIFIED IN VARIOUS PIPE INSULATION MATERIAL INSTALLATION ARTICLES.

B. INSULATION INSTALLATION ON FITTINGS, VALVES, STRAINERS, FLANGES, AND UNIONS:
1. INSTALL INSULATION OVER FITTINGS, VALVES, STRAINERS, FLANGES, UNIONS, AND OTHER SPECIALTIES WITH CONTINUOUS THERMAL AND VAPOR–RETARDER INTEGRITY, UNLESS OTHERWISE INDICATED.
2. INSULATE PIPE ELBOWS USING PREFORMED FITTING INSULATION OR MITERED FITTINGS MADE FROM SAME MATERIAL AND DENSITY AS ADJACENT PIPE INSULATION. EACH PIECE SHALL BE BUTTED TIGHTLY AGAINST ADJOINING PIECE AND BONDED WITH ADHESIVE. FILL JOINTS, SEAMS, VOIDS, AND IRREGULAR SURFACES WITH INSULATING CEMENT FINISHED TO A SMOOTH, HARD, AND UNIFORM CONTOUR THAT IS UNIFORM WITH ADJOINING PIPE INSULATION.
3. INSULATE TEE FITTINGS WITH PREFORMED FITTING INSULATION OR SECTIONAL PIPE INSULATION OF SAME MATERIAL AND THICKNESS AS USED FOR ADJACENT PIPE. CUT SECTIONAL PIPE INSULATION TO FIT. BUTT EACH SECTION CLOSELY TO THE NEXT AND HOLD IN PLACE WITH TIE WIRE. BOND PIECES WITH ADHESIVE.
4. INSULATE VALVES USING PREFORMED FITTING INSULATION OR SECTIONAL PIPE INSULATION OF SAME MATERIAL, DENSITY, AND THICKNESS AS USED FOR ADJACENT PIPE. OVERLAP ADJOINING PIPE INSULATION BY NOT LESS THAN TWO TIMES THE THICKNESS OF PIPE INSULATION, OR ONE PIPE DIAMETER, WHICHEVER IS THICKER. FOR VALVES, INSULATE UP TO AND INCLUDING THE BONNETS, VALVE STUFFING–BOX STUDS, BOLTS, AND NUTS. FILL JOINTS, SEAMS, AND IRREGULAR SURFACES WITH INSULATING CEMENT.
5. INSULATE STRAINERS USING PREFORMED FITTING INSULATION OR SECTIONAL PIPE INSULATION OF SAME MATERIAL, DENSITY, AND THICKNESS AS USED FOR ADJACENT PIPE. OVERLAP ADJOINING PIPE INSULATION BY NOT LESS THAN TWO TIMES THE THICKNESS OF PIPE INSULATION, OR ONE PIPE DIAMETER, WHICHEVER IS THICKER. FILL JOINTS, SEAMS, AND IRREGULAR SURFACES WITH INSULATING CEMENT. INSULATE STRAINERS SO STRAINER BASKET FLANGE OR PLUG CAN BE EASILY REMOVED AND REPLACED WITHOUT DAMAGING THE INSULATION AND JACKET. PROVIDE A REMOVABLE REUSABLE INSULATION COVER. FOR BELOW AMBIENT SERVICES, PROVIDE A DESIGN THAT MAINTAINS VAPOR BARRIER.
6. INSULATE FLANGES AND UNIONS USING A SECTION OF OVERSIZED PREFORMED PIPE INSULATION. OVERLAP ADJOINING PIPE INSULATION BY NOT LESS THAN TWO TIMES THE THICKNESS OF PIPE INSULATION, OR ONE PIPE DIAMETER, WHICHEVER IS THICKER.
7. COVER SEGMENTED INSULATED SURFACES WITH A LAYER OF FINISHING CEMENT AND COAT WITH A MASTIC. INSTALL VAPOR BARRIER MASTIC FOR BELOW AMBIENT SERVICES AND A BREATHER MASTIC FOR ABOVE AMBIENT SERVICES. REINFORCE THE MASTIC WITH FABRIC–REINFORCING MESH. TROWEL THE MASTIC TO A SMOOTH AND WELL–SHAPED CONTOUR.
8. FOR SERVICES NOT SPECIFIED TO RECEIVE A FIELD–APPLIED JACKET EXCEPT FOR FLEXIBLE ELASTOMERIC AND POLYOLEFIN, INSTALL FITTED PVC COVER OVER ELBOWS, TEES, STRAINERS, VALVES, FLANGES, AND UNIONS. TERMINATE ENDS WITH PVC ENDCAPS. TAPE CAPS. PVC COVERS TO ADJOINING INSULATION FACING USING PVC TAPE.
9. STENCIL OR LABEL THE OUTSIDE INSULATION JACKET OF EACH UNION WITH THE WORD "UNION." MATCH SIZE AND COLOR OF PIPE LABELS.

C. INSULATE INSTRUMENT CONNECTIONS FOR THERMOMETERS, PRESSURE GAGES, PRESSURE TEMPERATURE TAPS, TEST CONNECTIONS, FLOW METERS, SENSORS, SWITCHES, AND TRANSMITTERS ON INSULATED PIPES, VESSELS, AND EQUIPMENT. SHAPE INSULATION AT THESE CONNECTIONS BY TAPERING IT TO AND AROUND THE CONNECTION WITH INSULATING CEMENT AND FINISH WITH FINISHING CEMENT, MASTIC, AND FLASHING SEALANT.

D. INSTALL REMOVABLE INSULATION COVERS AT LOCATIONS INDICATED. INSTALLATION SHALL CONFORM TO THE FOLLOWING:
1. MAKE REMOVABLE FLANGE AND UNION INSULATION FROM SECTIONAL PIPE INSULATION OF SAME THICKNESS AS THAT ON ADJOINING PIPE. INSTALL SAME INSULATION JACKET AS ADJOINING PIPE INSULATION.
2. WHEN FLANGE AND UNION COVERS ARE MADE FROM SECTIONAL PIPE INSULATION, EXTEND INSULATION FROM FLANGES OR UNION LONG AT LEAST TWO TIMES THE INSULATION THICKNESS OVER ADJACENT PIPE INSULATION ON EACH SIDE OF FLANGE OR UNION. SECURE FLANGE COVER IN PLACE WITH STAINLESS–STEEL OR ALUMINUM BANDS. SELECT BAND MATERIAL COMPATIBLE WITH INSULATION AND JACKET.
3. CONSTRUCT REMOVABLE VALVE INSULATION COVERS IN SAME MANNER AS FOR FLANGES EXCEPT DIVIDE THE TWO–PART SECTION ON THE VERTICAL CENTER LINE OF VALVE BODY.
4. WHEN COVERS ARE MADE FROM BLOCK INSULATION, MAKE TWO HALVES, EACH CONSISTING OF MITERED BLOCKS WIRED TO STAINLESS–STEEL FABRIC. SECURE THIS WIRE FRAME, WITH ITS ATTACHED INSULATION, TO FLANGES WITH TIE WIRE. EXTEND INSULATION AT LEAST 2 INCHES OVER ADJACENT PIPE INSULATION ON EACH SIDE OF VALVE. FILL SPACE BETWEEN FLANGE OR UNION COVER AND PIPE INSULATION WITH INSULATING CEMENT. FINISH COVER ASSEMBLY WITH INSULATING CEMENT APPLIED IN TWO COATS. AFTER FIRST COAT IS DRY, APPLY AND TROWEL SECOND COAT TO A SMOOTH FINISH.
5. UNLESS A PVC JACKET IS INDICATED IN FIELD–APPLIED JACKET SCHEDULES, FINISH EXPOSED SURFACES WITH A METAL JACKET.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. SEAL LONGITUDINAL SEAMS AND END JOINTS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

B. INSULATION INSTALLATION ON PIPE FLANGES:
1. INSTALL PIPE INSULATION TO OUTER DIAMETER OF PIPE FLANGE.
2. MAKE WIDTH OF INSULATION SECTION SAME AS OVERALL WIDTH OF FLANGE AND BOLTS, PLUS TWICE THE THICKNESS OF PIPE INSULATION.
3. FILL VOIDS BETWEEN INNER CIRCUMFERENCE OF FLANGE INSULATION AND OUTER CIRCUMFERENCE OF ADJACENT STRAIGHT PIPE SEGMENTS WITH CUT SECTIONS OF SHEET INSULATION OF SAME THICKNESS AS PIPE INSULATION.
4. SECURE INSULATION TO FLANGES AND SEAL SEAMS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

C. INSULATION INSTALLATION ON PIPE FITTINGS AND ELBOWS:
1. INSTALL MITERED SECTIONS OF PIPE INSULATION.
2. SECURE INSULATION MATERIALS AND SEAL SEAMS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

D. INSULATION INSTALLATION ON VALVES AND PIPE SPECIALTIES:
1. INSTALL PREFORMED VALVE COVERS MANUFACTURED OF SAME MATERIAL AS PIPE INSULATION WHEN AVAILABLE.
2. WHEN PREFORMED VALVE COVERS ARE NOT AVAILABLE, INSTALL CUT SECTIONS OF PIPE AND SHEET INSULATION TO VALVE BODY. ARRANGE INSULATION TO PERMIT ACCESS TO PACKING AND TO ALLOW VALVE OPERATION WITHOUT DISTURBING INSULATION.
3. INSTALL INSULATION TO FLANGES AS SPECIFIED FOR FLANGE INSULATION APPLICATION.
4. SECURE INSULATION TO VALVES AND SPECIALTIES AND SEAL SEAMS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

3.7 MINERAL–FIBER INSULATION INSTALLATION

A. INSULATION INSTALLATION ON STRAIGHT PIPES AND TUBES:
1. SECURE EACH LAYER OF PREFORMED PIPE INSULATION TO PIPE WITH WIRE OR BANDS AND TIGHTEN BANDS WITHOUT DEFORMING INSULATION MATERIALS.
2. WHERE VAPOR BARRIERS ARE INDICATED, SEAL LONGITUDINAL SEAMS, END JOINTS, AND PROTRUSIONS WITH VAPOR–BARRIER MASTIC AND JOINT SEALANT.
3. FOR INSULATION WITH FACTORY–APPLIED JACKETS ON ABOVE AMBIENT SURFACES, SECURE LAPS WITH OUTWARD CLINCHED STAPLES AT 6 INCHES O.C.
4. FOR INSULATION WITH FACTORY–APPLIED JACKETS ON BELOW AMBIENT SURFACES, DO NOT STAPLE LONGITUDINAL TABS BUT SECURE TABS WITH ADDITIONAL ADHESIVE AS RECOMMENDED BY INSULATION MATERIAL MANUFACTURER AND SEAL WITH VAPOR BARRIER MASTIC AND FLASHING SEALANT.

B. INSULATION INSTALLATION ON PIPE FLANGES:
1. INSTALL PREFORMED PIPE INSULATION TO OUTER DIAMETER OF PIPE FLANGE.
2. MAKE WIDTH OF INSULATION SECTION SAME AS OVERALL WIDTH OF FLANGE AND BOLTS, PLUS TWICE THE THICKNESS OF PIPE INSULATION.
3. FILL VOIDS BETWEEN INNER CIRCUMFERENCE OF FLANGE INSULATION AND OUTER CIRCUMFERENCE OF ADJACENT STRAIGHT PIPE SEGMENTS WITH MINERAL–FIBER BLANKET INSULATION.
4. INSTALL JACKET MATERIAL WITH MANUFACTURER'S RECOMMENDED ADHESIVE, OVERLAP SEAMS AT LEAST 1 INCH, AND SEAL JOINTS WITH FLASHING SEALANT.

C. INSULATION INSTALLATION ON PIPE FITTINGS AND ELBOWS:
1. INSTALL PREFORMED SECTIONS OF SAME MATERIAL AS STRAIGHT SEGMENTS OF PIPE INSULATION WHEN AVAILABLE.
2. WHEN PREFORMED INSULATION ELBOWS AND FITTINGS ARE NOT AVAILABLE, INSTALL MITERED SECTIONS OF PIPE INSULATION, TO A THICKNESS EQUAL TO ADJOINING PIPE INSULATION. SECURE INSULATION MATERIALS WITH WIRE OR BANDS.

D. INSULATION INSTALLATION ON VALVES AND PIPE SPECIALTIES:
1. INSTALL PREFORMED SECTIONS OF SAME MATERIAL AS STRAIGHT SEGMENTS OF PIPE INSULATION WHEN AVAILABLE.
2. WHEN PREFORMED SECTIONS ARE NOT AVAILABLE, INSTALL MITERED SECTIONS OF PIPE INSULATION TO VALVE BODY.
3. ARRANGE INSULATION TO PERMIT ACCESS TO PACKING AND TO ALLOW VALVE OPERATION WITHOUT DISTURBING INSULATION.
4. INSTALL INSULATION TO FLANGES AS SPECIFIED FOR FLANGE INSULATION APPLICATION.

3.8 POLYOLEFIN INSULATION INSTALLATION

A. INSULATION INSTALLATION ON STRAIGHT PIPES AND TUBES:
1. SEAL SPLIT–TUBE LONGITUDINAL SEAMS AND END JOINTS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

B. INSULATION INSTALLATION ON PIPE FLANGES:
1. INSTALL PIPE INSULATION TO OUTER DIAMETER OF PIPE FLANGE.
2. MAKE WIDTH OF INSULATION SECTION SAME AS OVERALL WIDTH OF FLANGE AND BOLTS, PLUS TWICE THE THICKNESS OF PIPE INSULATION.
3. FILL VOIDS BETWEEN INNER CIRCUMFERENCE OF FLANGE INSULATION AND OUTER CIRCUMFERENCE OF ADJACENT STRAIGHT PIPE SEGMENTS WITH CUT SECTIONS OF POLYOLEFIN SHEET INSULATION OF SAME THICKNESS AS PIPE INSULATION.
4. SECURE INSULATION TO FLANGES AND SEAL SEAMS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

C. INSULATION INSTALLATION ON PIPE FITTINGS AND ELBOWS:
1. INSTALL MITERED SECTIONS OF POLYOLEFIN PIPE INSULATION.
2. SECURE INSULATION MATERIALS AND SEAL SEAMS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

D. INSULATION INSTALLATION ON VALVES AND PIPE SPECIALTIES:
1. INSTALL CUT SECTIONS OF POLYOLEFIN PIPE AND SHEET INSULATION TO VALVE BODY.
2. ARRANGE INSULATION TO PERMIT ACCESS TO PACKING AND TO ALLOW VALVE OPERATION WITHOUT DISTURBING INSULATION.
3. INSTALL INSULATION TO FLANGES AS SPECIFIED FOR FLANGE INSULATION APPLICATION.
4. SECURE INSULATION TO VALVES AND SPECIALTIES, AND SEAL SEAMS WITH MANUFACTURER'S RECOMMENDED ADHESIVE TO ELIMINATE OPENINGS IN INSULATION THAT ALLOW PASSAGE OF AIR TO SURFACE BEING INSULATED.

3.9 FIELD–APPLIED JACKET INSTALLATION

A. WHERE FSK JACKETS ARE INDICATED, INSTALL AS FOLLOWS:
1. DRAW JACKET MATERIAL SMOOTH AND TIGHT.
2. INSTALL LAP OR JOINT STRIPS WITH SAME MATERIAL AS JACKET.
3. SECURE JACKET TO INSULATION WITH MANUFACTURER'S RECOMMENDED ADHESIVE.
4. INSTALL JACKET WITH 1–1/2–INCH LAPS AT LONGITUDINAL SEAMS AND 3–INCH– WIDE JOINT STRIPS AT END JOINTS.
5. SEAL OPENINGS, PUNCTURES, AND BREAKS IN VAPOR–RETARDER JACKETS AND EXPOSED INSULATION WITH VAPOR–BARRIER MASTIC.

B. WHERE PVC JACKETS ARE INDICATED, INSTALL WITH 1–INCH OVERLAP AT LONGITUDINAL SEAMS AND END JOINTS; FOR HORIZONTAL APPLICATIONS, INSTALL WITH LONGITUDINAL SEAMS ALONG TOP AND BOTTOM OF TANKS AND VESSELS. SEAL WITH MANUFACTURER'S RECOMMENDED ADHESIVE.
1. APPLY TWO CONTINUOUS BEADS OF ADHESIVE TO SEAMS AND JOINTS, ONE BEAD UNDER LAP AND THE FINISH BEAD ALONG SEAM AND JOINT EDGE.

C. WHERE METAL JACKETS ARE INDICATED, INSTALL WITH 2–INCH OVERLAP AT LONGITUDINAL SEAMS AND END JOINTS. OVERLAP LONGITUDINAL SEAMS ARRANGED TO SHED WATER. SEAL END JOINTS WITH WEATHERPROOF SEALANT RECOMMENDED BY INSULATION MANUFACTURER. SECURE JACKET WITH STAINLESS–STEEL BANDS 12 INCHES O.C. AND AT END JOINTS.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. FOLLOW SCHEDULES ILLUSTRATED ON THE DRAWINGS FOR THICKNESS, MATERIAL AND FINISH NEEDS.

B. ITEMS NOT INSULATED: UNLESS OTHERWISE INDICATED, DO NOT INSTALL INSULATION ON THE FOLLOWING:
1. DRAINAGE PIPING LOCATED IN CRAWL SPACES.
2. UNDERGROUND PIPING.
3. CHROME–PLATED PIPES AND FITTINGS UNLESS THERE IS A POTENTIAL FOR PERSONNEL INJURY.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

PLUMBING SPECIFICATIONS

SHEET NO.: P0.04

PLUMBING EQUIPMENT SCHEDULE

MARK	FIXTURES				TRIM			ACCESSORIES							SUPPLY SIZE		WASTE SIZE	NOTES	RIM HEIGHT	FLUSH VALVE HEIGHT	BUBBLER HEIGHT
	DESCRIPTION	ADA	MANUF.	FIXTURE MODEL NO.	FLUSH VALVE MODEL NUMBER	MANUF.	TRIM MODEL NO.	SEATS	SUPPLIES	STRAINER	TRAP	CONTINUOUS WASTE	INSULATION KIT	MANUF.	CW	HW					
P–1	WATER CLOSET	ADA	AM. STANDARD	2386.012	–	–	–	9400CT	2166LK	–	–	–	–	CHURCH/McGUIRE	1/2"	–	3"	1, 2, 3	16–1/2"	–	–
P–2	WATER CLOSET	–	AM. STANDARD	2383.012	–	–	–	9400CT	2166LK	–	–	–	–	CHURCH/McGUIRE	1/2"	–	3"	2, 3	15"	–	–
P–3	URINAL	ADA	AM. STANDARD	6590.001	(ROYAL) 186–0.5	SLOAN	–	–	–	–	–	–	–	–	1"	–	2"	3, 4	15–1/4"	44–3/4"	–
P–4	LAVATORY	ADA	AM. STANDARD	0476.028	–	DELTA	22C151	–	2165LK	155WC	8902	–	PW2000WC	McGUIRE	1/2"	1/2"	2"	2, 3	34"	–	–
P–5	WATER COOLER	ADA	ELKAY	EZSTL8WSLK	–	–	–	–	–	–	8912	–	–	–	1/2"	–	2"	3	–	–	32–7/8" / 38–3/8"
P–6	MOP SINK	–	STERN WILLIAMS	SB–902	–	T&S BRASS	B–0657	–	–	–	–	–	–	–	3/4"	3/4"	3"	5, 6	12"	–	–

NOTES

1. HANDICAPPED, FLOOR MOUNTED TOILET.
2. ALL SUPPLIES AND WASTE ASSEMBLIES SHALL BE CHROME PLATED.
3. USE WHITE SILICONE CAULK TO SEAL AROUND THE PERIMETER OF ALL PLUMBING FIXTURES WHERE THE FIXTURE MAKES CONTACT WITH THE BUILDING STRUCTURE.
4. PROVIDE JAY R. SMITH FIXTURE SUPPORT AS REQUIRED TO MATCH FIXTURE.
5. PROVIDE WITH STAINLESS STEEL WALL GUARD, HOSE AND BRACKET, AND 3 POSITION MOP HANGER. SEE DETAIL FOR CLARIFICATION.
6. WHEN FAUCETS BY ALTERNATE MANUFACTURERS ARE PROVIDED, CERAMIC CHECK VALVES MUST BE PROVIDED TO PREVENT DCW/DHW CROSSOVER.

PLUMBING PIPING APPLICATION CHART

LINE	SYSTEM	PIPE SIZE	PRESSURE RANGE	MATERIAL	ASTM STANDARD	MANUF. PROCESS	WEIGHT	JOINT	PRESSURE RATING (PSIG)
1	DOMESTIC HOT AND COLD WATER PIPING	ALL SIZES ABOVE GROUND	–	PEX (HDPE)	ASTM F876/F877	EXTRUDED	–	LEAD FREE PEX	100
2	DOMESTIC HOT AND COLD WATER PIPING	NPS 4" AND SMALLER	–	WROUGHT COPPER	B 88	DRAWN	TYPE L	95–5 SOLDER	350
3	DOMESTIC COLD WATER PIPING (UNDERGROUND)	NPS 2" AND SMALLER	–	WROUGHT COPPER	B 88	DRAWN	TYPE K	BRAZED	350
4	SANITARY PIPING	ALL SIZES BELOW GROUND	–	PVC DWV	ASTM D–2665	EXTRUDED	SCHEDULE 40	SOLVENT CEMENT	–
5	SANITARY AND VENT PIPING	ALL SIZES ABOVE GROUND	–	NO HUB CAST IRON	ASTM A 74 CISPI 301	CAST	SERVICE WEIGHT	COMPRESSION COUPLINGS	–

FITTING APPLICATION

MATERIAL	CLASS	JOINT
LEAD FREE PEX	–	LEAD FREE PEX
WROUGHT COPPER	–	95–5 SOLDER
WROUGHT COPPER	–	BRAZED
PVC DWV	–	SOLVENT CEMENT
NO HUB CAST IRON	–	COMPRESSION COUPLINGS

NOTE:

1. REFER TO SPECIFICATIONS FOR MARKING REQUIREMENTS. ADHESIVE LABELS ARE NOT ACCEPTABLE.
2. USE PEX PIPING IN JOISTS ONLY.

PIPE INSULATION SCHEDULE

SERVICE	INSULATION TYPE	FINISH / JACKET		MAINS					RUNOUTS
		INDOOR	OUTDOOR	1–1/4" AND LESS	1 1/2" TO 2"	2 1/2" TO 4"	5" TO 6"	8"	UP TO 1"
DOMESTIC COLD WATER	FLEXIBLE ELASTOMERIC	–	–	0.5"	–	–	–	–	0.5"
DOMESTIC HOT WATER	FLEXIBLE ELASTOMERIC	–	–	1"	–	–	–	–	0.5"

NOTE:

1. PROTECT INDIRECT HUNG PIPING WITH GALVANIZED INSULATION PROTECTION SHIELDS.
2. ALL PIPING SHALL HAVE INSULATION CONTINUOUS THROUGH HANGERS.
3. PROVIDE CONTINUOUS VAPOR BARRIER ON ALL DOMESTIC HOT AND COLD WATER PIPING.
4. TIGHTEN ALL HANGER NUTS AFTER INSTALLATION OF INSULATION THROUGH HANGERS.
5. RUNOUTS INDICATE PIPING TO INDIVIDUAL UNITS, NOT EXCEEDING 12 FEET IN LENGTH.

PLUMBING VALVE APPLICATION CHART

LINE	SYSTEM	PIPE SIZE	TYPE	MODEL	MANUF.
1	INLET AND OUTLET OF WATER HEATERS	2" AND BELOW	FULL PORT, BALL VALVE	S–585–66–LF	NIBCO
2	DOMESTIC HOT AND COLD WATER PIPING	1/2" TO 2"	CHECK VALVES (VERTICAL)	S–480–Y–LF	NIBCO
3	DOMESTIC HOT AND COLD WATER PIPING	1/2" TO 2"	CHECK VALVES (HORIZONTAL)	S–413–Y–LF	NIBCO

NOTE:

1. CONTRACTOR SHALL PROVIDE ALL ISOLATION VALVES TO ACHIEVE THE DESIGN INTENT.
2. PROVIDE STAINLESS STEEL BALL AND STEM, PER NOTED OPTIONS ABOVE.
3. PROVIDE EXTENDED HANDLES FOR ALL INSULATED PIPING SYSTEMS TO ACCOMMODATE VALVE OPERATION WITHOUT DAMAGING INSULATION. SEE INSULATION SCHEDULE FOR COORDINATION.
4. VALVES WHICH ARE NOT LEAD FREE CERTIFIED MAY ONLY BE USED FOR INDIVIDUAL NON–CONSUMPTION EQUIPMENT CONNECTIONS WITH APPROVAL IN ADVANCE FROM THE AHJ.
5. PROVIDE EXTENDED VALVE HANDLES ON VALVES MOUNTED IN INSULATED PIPING. LENGTH OF EXTENDED HANDLES SHALL SUIT INSULATION THICKNESS.

HYDRANT SCHEDULE

MARK	MANUFACTURER	MODEL NUMBER	SIZE	NOTES
HB–1	JAY R. SMITH	5670–H	3/4"	1, 2

NOTES:

1. PROVIDE WITH HOSE VACUUM BREAKER.
2. INSTALL BACKFLOW PREVENTER ON SUPPLY PIPING. SEE PLANS FOR COORDINATION.

FLOOR DRAIN SCHEDULE

MARK	MANUFACTURER	MODEL NUMBER	SIZE	NOTES
FD–1	JAY R. SMITH	2005LXH–A05NB–P050	NOTE 3	1, 2, 4

NOTES:

1. SPEEDI–SET CONNECTION, TOILETS, SMALL MECHANICAL ROOMS.
2. USE DEEP SEAL TRAPS ON ALL FLOOR DRAINS.
3. MATCH PIPE SIZE SHOWN ON PLANS.
4. PROVIDE TRAP PRIMERS FOR ALL FLOOR DRAINS UNLESS SPECIFICALLY NOTED OTHERWISE.

MIXING VALVE SCHEDULE

MARK	MANUFACTURER	MODEL NUMBER	RATING	FLOW (GPM)	CONNECTION SIZE INLET / OUTLET	PRESSURE LOSS AT RATED FLOW	NOTES
MV–1	WATTS	LF1170–US–M2	ASSE 1017	0.5–5 GPM	3/4" / 3/4"	< 5 PSIG	2
MV–2	WATTS	LFMMV–US–M1	ASSE 1070	0.5–2.5 GPM	3/8" / 3/8"	< 5 PSIG	1, 3

NOTES:

1. THE DESIGN INTENT FOR MV–2 IS TO PROVIDE TEMPERED WATER (109F MAX) AT EACH FIXTURE, USING THE 120F DHW SUPPLY.
2. THE DESIGN INTENT FOR MV–1 IS TO PROVIDE 120F WATER FOR DISTRIBUTION.
3. THE LISTED VALVE IS TRIPLE LISTED FOR ASSE 1017 (MASTER MIXER), ASSE 1016 (SHOWERS AND TUBS) AND ASSE 1070 (POINT OF USE) STANDARDS, WHEN A SEPARATE VALVE IS SUPPLIED FOR EACH RATING.

INSTANTANEOUS WATER HEATER SCHEDULE

MARK	MANUFACTURER	MODEL NUMBER	CAPACITY (GALLONS)	GPM RECOVERY 41°F RISE	AMPS	VOLT/PH/HZ	NOTES
EWH–1	EEMAX	EX180T2T ML	0	3	50 A/PHASE	208/3/60	1, 2, 3, 4, 5

NOTES:

1. ADJUST OUTPUT TO 120°F.
2. TURN ON GPM = 0.3.
3. REPLACEABLE ELEMENT CARTRIDGE, NICKEL CHROME MATERIAL.
4. 1/2" NPT FITTINGS.
5. INSTALL UPRIGHT WITH CONNECTIONS ON THE BOTTOM.

BACKFLOW PREVENTER SCHEDULE

MARK	USE	MANUFACTURER / MODEL NUMBER	ASSE RATING	SIZE	NOTES
BFP–1	MAIN WATER ENTRANCE	WATTS / LF909	1013	NOTE 1	1, 2, 3

NOTES:

1. MATCH PIPE SIZE SHOWN ON PLANS.
2. SEE MANUFACTURERS INSTALLATION INSTRUCTIONS FOR COORDINATION.
3. ALL BACKFLOW PREVENTERS SERVING POTABLE WATER SYSTEMS SHALL MEET LEAD FREE REQUIREMENTS. COORDINATE EXEPTIONS (EX. MECHANICAL EQUIPMENT MAKEUP) WITH AHJ PRIOR TO INSTALLATION.

TRAP PRIMER SCHEDULE

MARK	MANUFACTURER	MODEL NUMBER	SIZE	NOTES
TP–1	PRECISION PLUMBING PRODUCTS	P2–500	1/2" NPT	1, 2

NOTES:

1. INSTALL TP–1'S WHEREVER TRAP PRIMERS ARE NOTED, UNLESS ANOTHER TRAP PRIMER IS SPECIFICALLY NOTED. INSTALL DU–U ADAPTERS WHERE REQUIRED TO CONNECT ADDITIONAL LINES.
2. CONNECT OFF TOP OF SUPPLY PIPING TO PREVENT DEBRIS BUILD UP, AS SHOWN ON DETAILS.

CLEANOUT SCHEDULE

MARK	MANUFACTURER	MODEL NUMBER	SIZE	NOTES
CO–1	JAY R. SMITH	4031LXH–NB	NOTE 2	1

NOTES:

1. FINISHED AREAS, SPEEDI–SET, SEE DRAWINGS FOR SIZE.
2. MATCH PIPE SIZE SHOWN ON PLANS.

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REVISIONS:

DATE: 05-17-2016

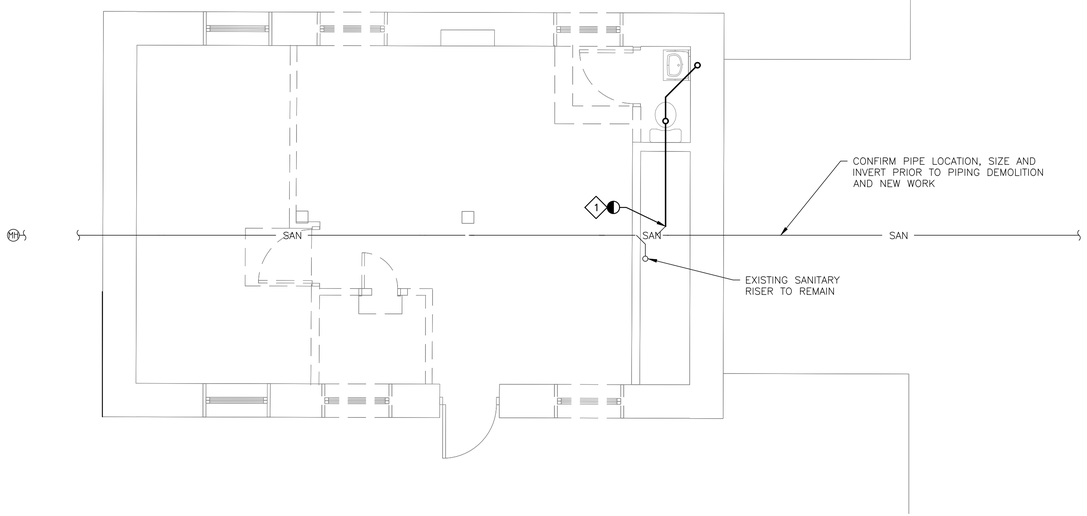
PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

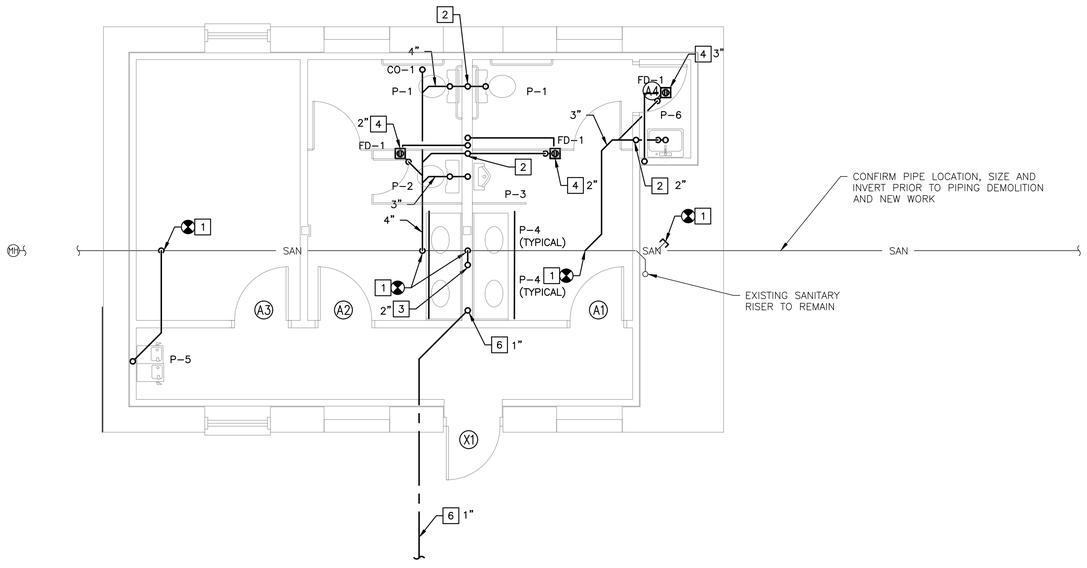
PLUMBING SCHEDULES

SHEET NO.:
P0.05



PLUMBING BELOW GRADE DEMOLITION PLAN

SCALE: 1/4" = 1'-0"



PLUMBING BELOW GRADE PLAN

SCALE: 1/4" = 1'-0"

CONNECTION SIZES

MARK	DCW	DHW	SAN/VENT
P-1	1/2"	–	3"
P-2	1/2"	–	3"
P-3	1"	–	2"
P-4	1/2"	1/2"	2"
P-5	1/2"	–	2"
P-6	1/2"	1/2"	3"

GENERAL NOTES

1. CONTRACTOR IS RESPONSIBLE FOR ALL CUTTING, PATCHING AND DEMOLITION PER THEIR MEANS–AND–METHODS AS NECESSARY TO PROVIDE THE DESIGN INDICATED.
2. COORDINATE ALL UTILITY AND EQUIPMENT SHUT DOWNS WITH THE OWNER.

◇ DEMOLITION NOTES

1. REMOVE SANITARY PIPING SERVING EXISTING WATER CLOSET AND LAVATORY.

□ CONSTRUCTION NOTES

1. INSTALL SANITARY PIPING AS HIGH AS POSSIBLE TO SERVE NEW FIXTURES. COORDINATE WITH STRUCTURAL PLANS.
2. INSTALL 2" VENT UP TO FIRST FLOOR CEILING.
3. INSTALL 2" SAN UP TO SERVE LAVATORIES ABOVE.
4. INSTALL FLOOR DRAIN, SAN PIPING, TRAP, AND 1/2" DCW SERVED BY TRAP PRIMER ABOVE.
5. CAP SANITARY PIPING AT BRANCH AS SHOWN. MATCH EXISTING SIZE.
6. INSTALL 1" DCW PIPING MAIN FROM VALVE UNDER SIDEWALK AS SHOWN. INSTALL UP IN WALL AND ROUTE TO BACKFLOW PREVENTER SHOWN ON ABOVE GRADE PLANS.

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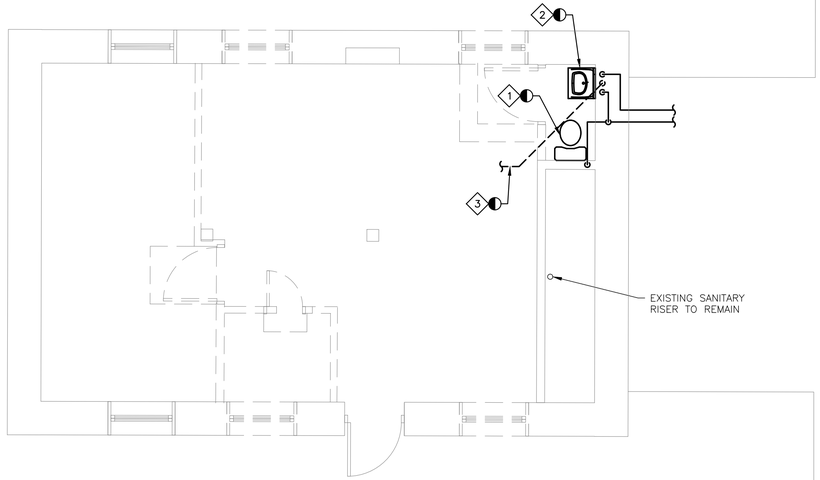
EXP./CLIENT NO: N/A

SCALE: 1/4" = 1'-0"

PLUMBING BELOW GRADE PLANS

SHEET NO.:
P1.01



DEMOLITION PLAN

PLUMBING DEMOLITION PLAN

SCALE: 1/4" = 1'-0"

CONNECTION SIZES

MARK	DCW	DHW	SAN/VENT
P-1	1/2"	–	3"
P-2	1/2"	–	3"
P-3	1"	–	2"
P-4	1/2"	1/2"	2"
P-5	1/2"	–	2"
P-6	1/2"	1/2"	3"

GENERAL NOTES

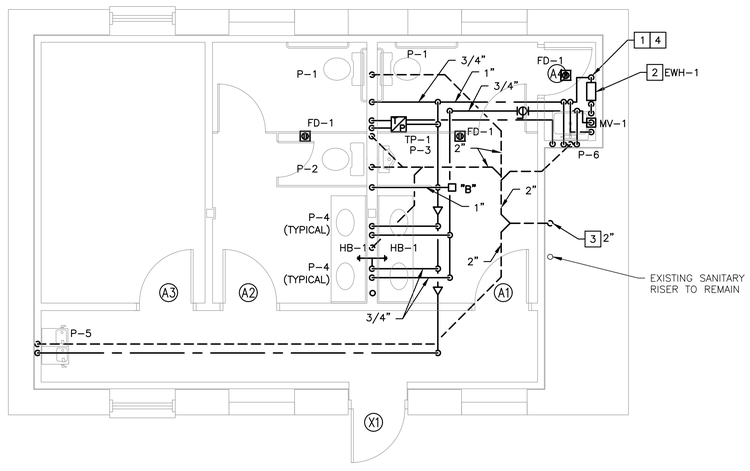
1. CONTRACTOR IS RESPONSIBLE FOR ALL CUTTING, PATCHING AND DEMOLITION PER THEIR MEANS-AND-METHODS AS NECESSARY TO PROVIDE THE DESIGN INDICATED.
2. COORDINATE ALL UTILITY AND EQUIPMENT SHUT DOWNS WITH THE OWNER.

◇ DEMOLITION NOTES

1. REMOVE WATER CLOSET AND ASSOCIATED PIPING BACK TO BRANCH. VALVE AND CAP DCW AT BRANCH.
2. REMOVE LAVATORY, SUPPORT, DCW, DHW, SANITARY, AND VENT PIPING COMPLETE. CAP AND VALVE DCW AND DHW AT BRANCH.
3. REMOVE VENT PIPING SERVING EXISTING FIXTURES COMPLETE.

□ CONSTRUCTION NOTES

1. INSTALL 1" DCW BRANCH UP FROM NEW CONNECTION. INSTALL BFP-1 IN VERTICAL.
2. INSTALL EWH-1 MOUNTED ON WALL. INSTALL MV-1 AND COORDINATE WITH DETAIL AND MANUFACTURER'S INSTALLATION REQUIREMENTS FOR WATER HEATER INSTALLATION. INSTALL ALL PIPING AS HIGH AS POSSIBLE TO AVOID INTERFERENCE WITH DOOR AND MOP SINK.
3. INSTALL 2" VENT PIPING ROUTED TO EXISTING CHIMNEY AND TERMINATE ON ROOF VIA BEST ROUTE AVAILABLE.
4. INSTALL TEE, BALL VALVE, AND THREADED PIPE CAP. THE DESIGN INTENT IS TO PROVIDE A POINT OF PRESSURIZATION SUCH THAT THE PIPING SERVING RESTROOMS SHALL BE DRAINED DURING COLD WEATHER MONTHS.



PLUMBING PLAN

SCALE: 1/4" = 1'-0"

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REVISIONS:

DATE: 05-17-2016

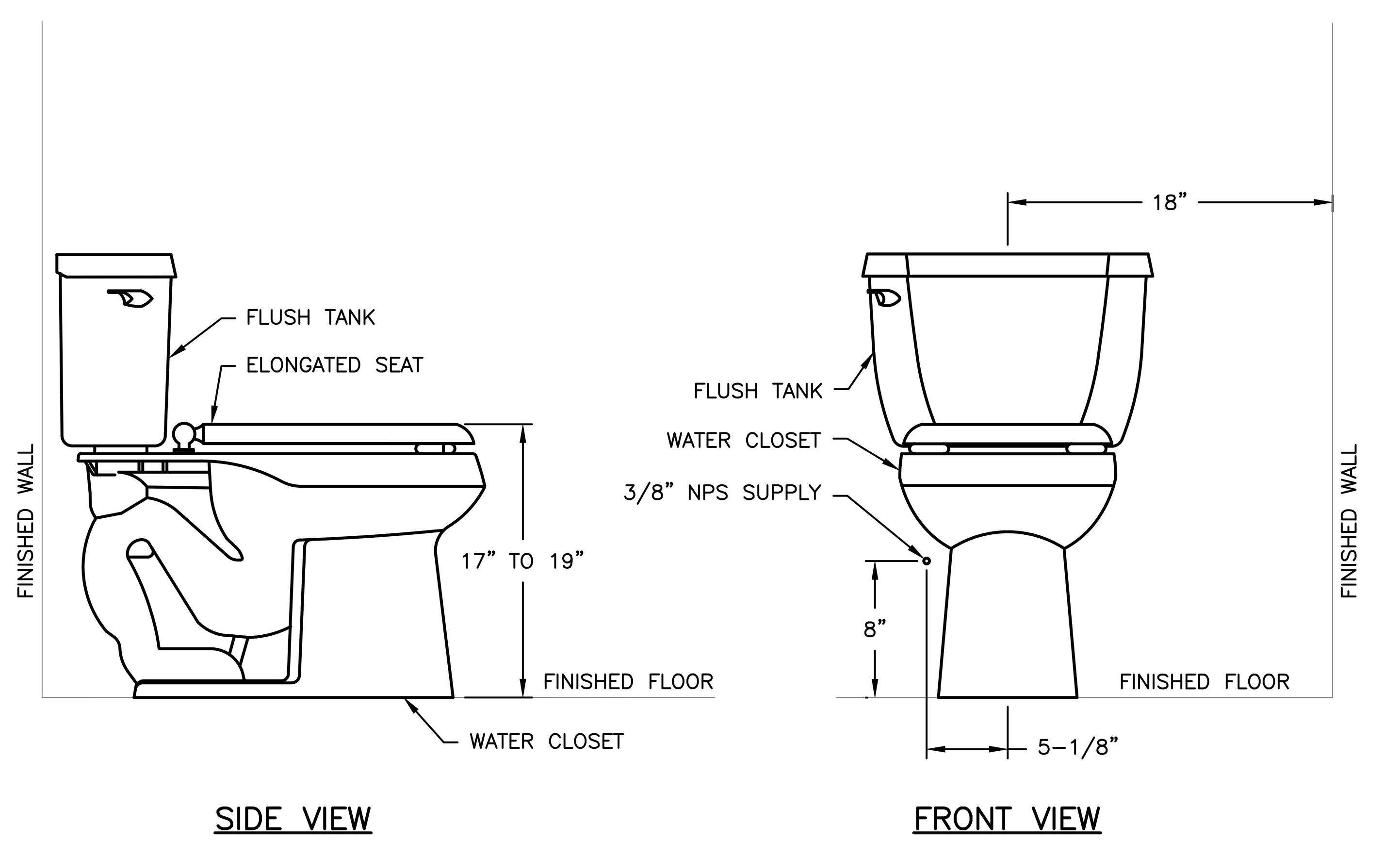
PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: 1/4" = 1'-0"

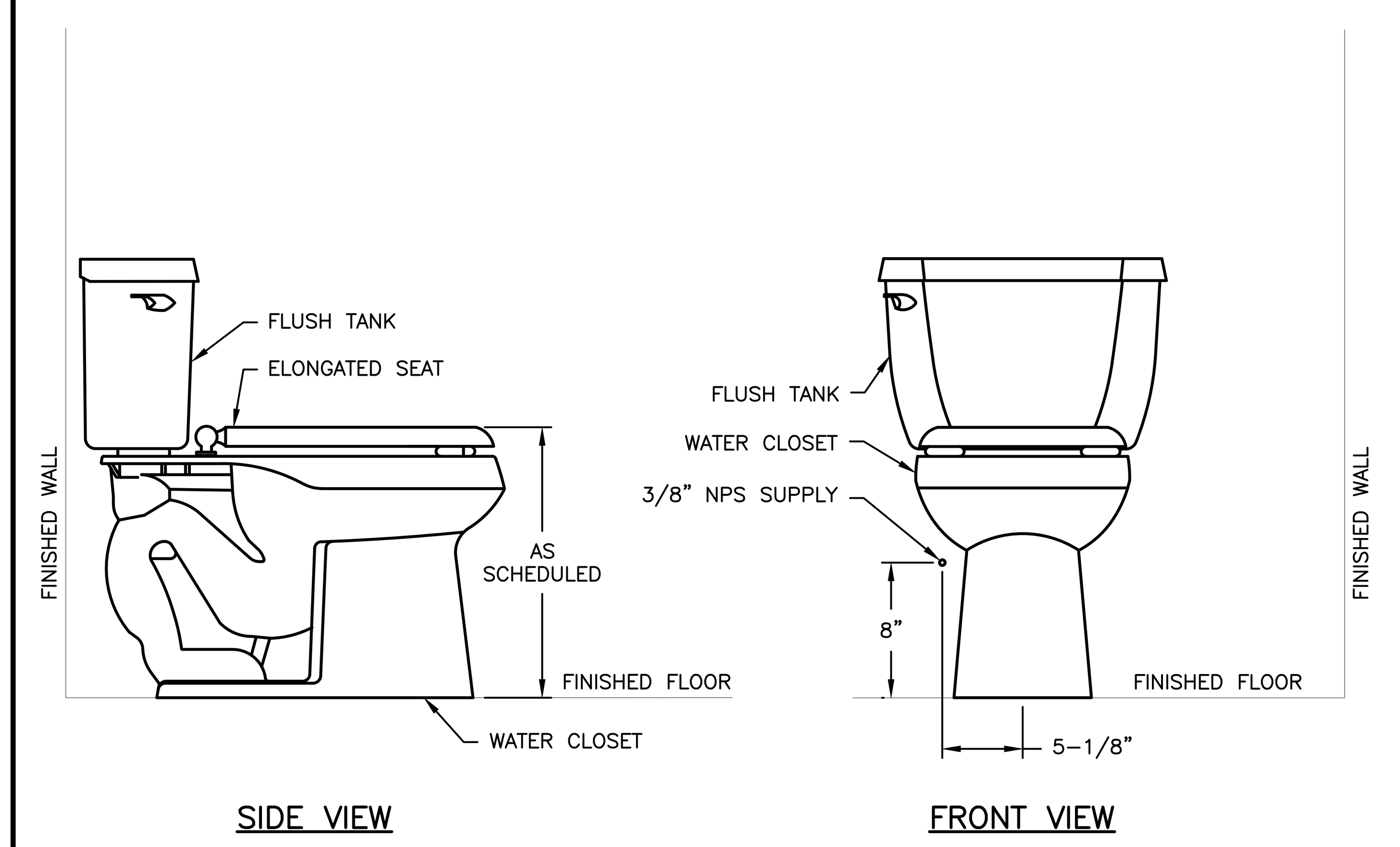
PLUMBING PLANS

SHEET NO.:
P2.01



ADA WATER CLOSET

NOT TO SCALE



WATER CLOSET

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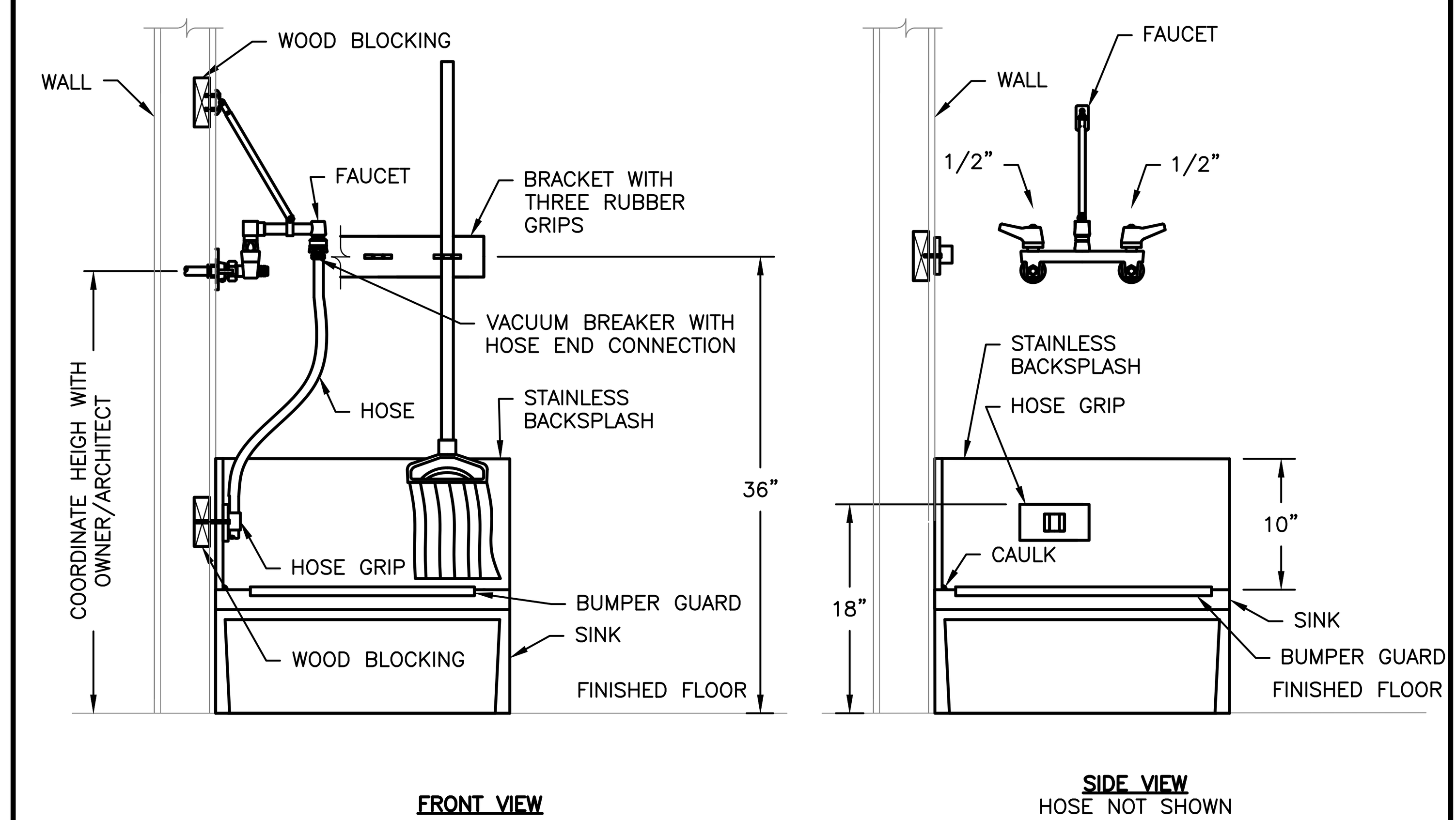
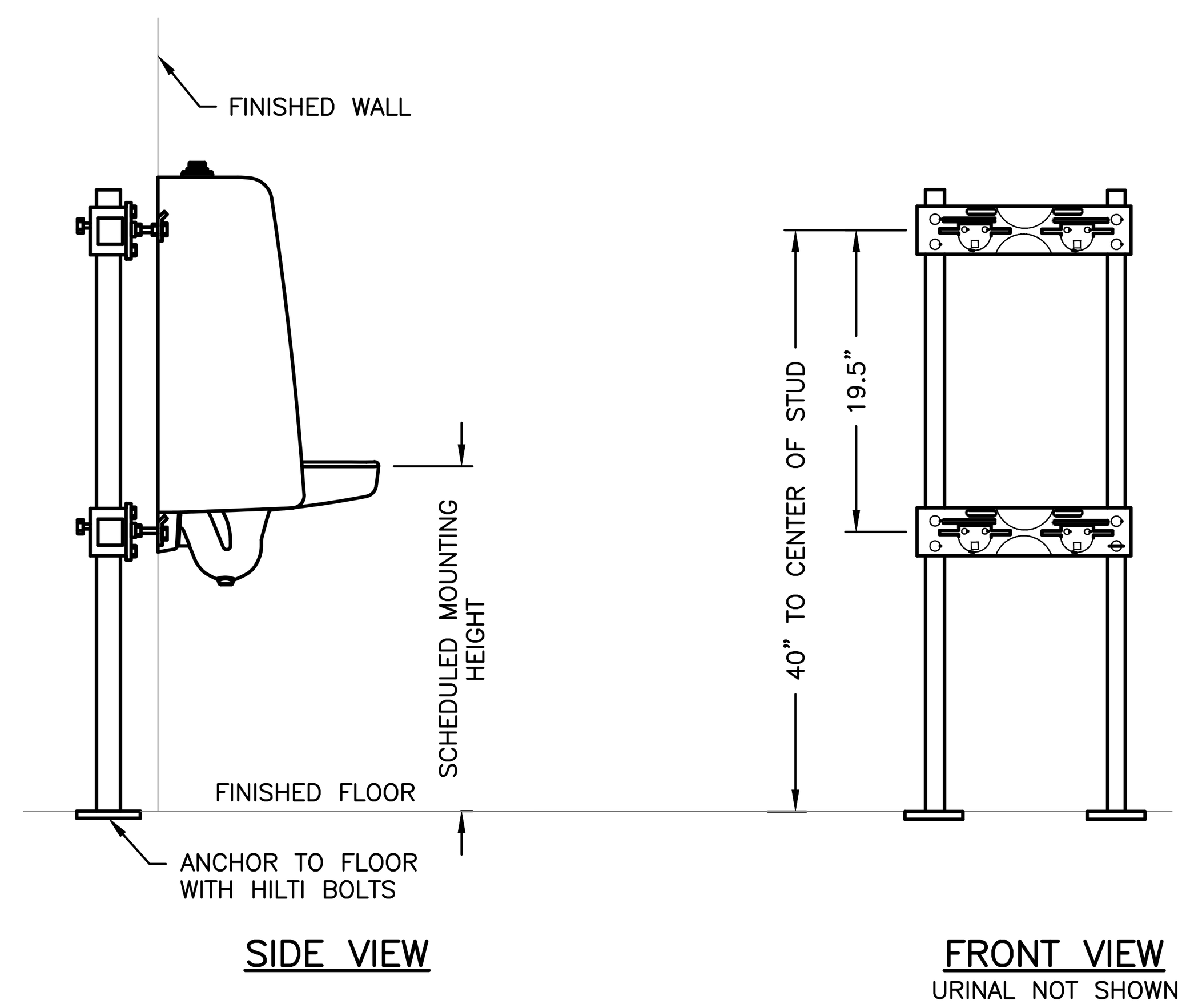


MOP SINK DETAIL

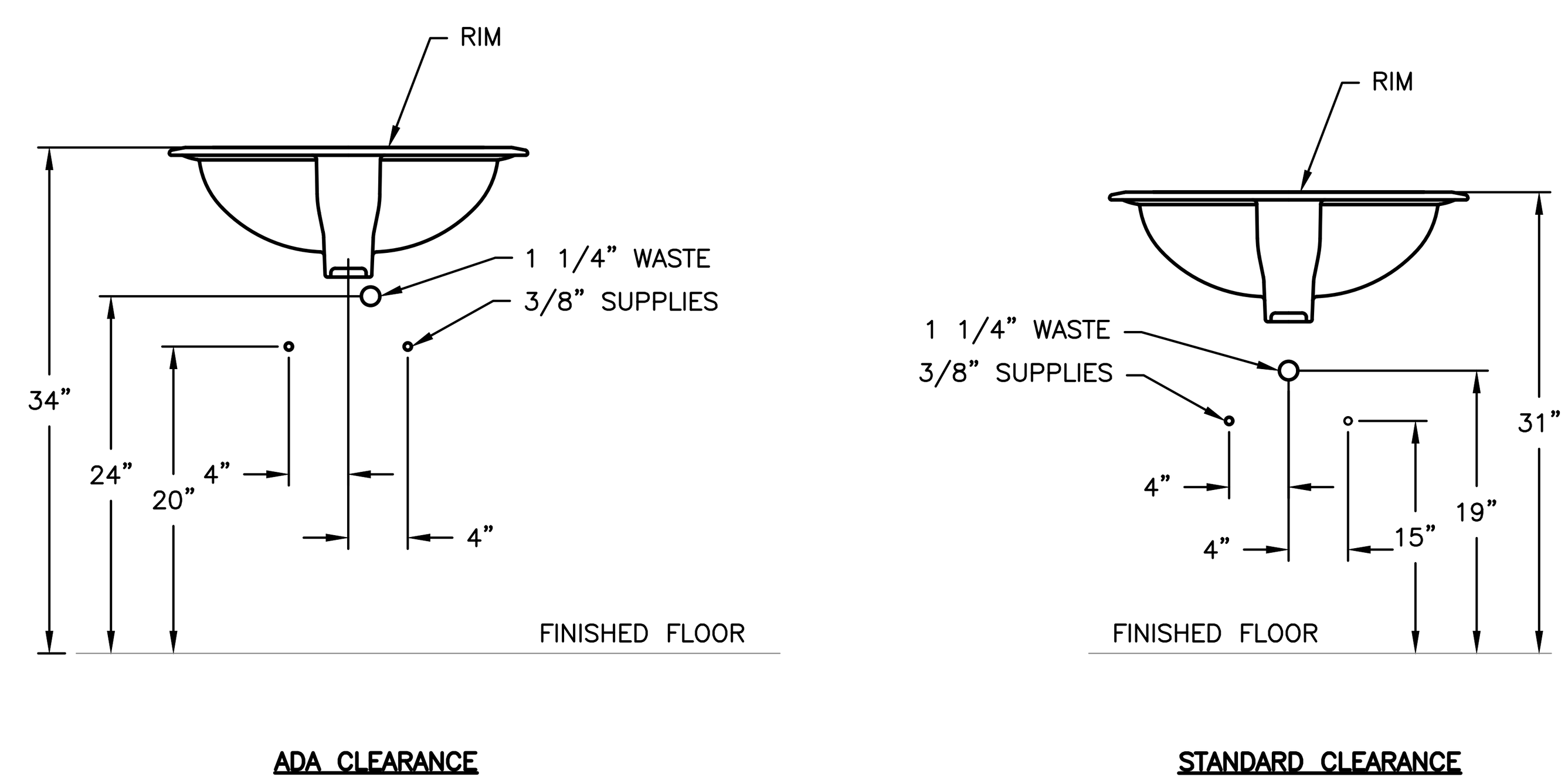
NOT TO SCALE



NOTE:
1. CONTRACTOR SHALL VERIFY DIMENSIONS FROM ROUGH IN DATA SHEETS AND SCHEDULED MOUNTING HEIGHTS.

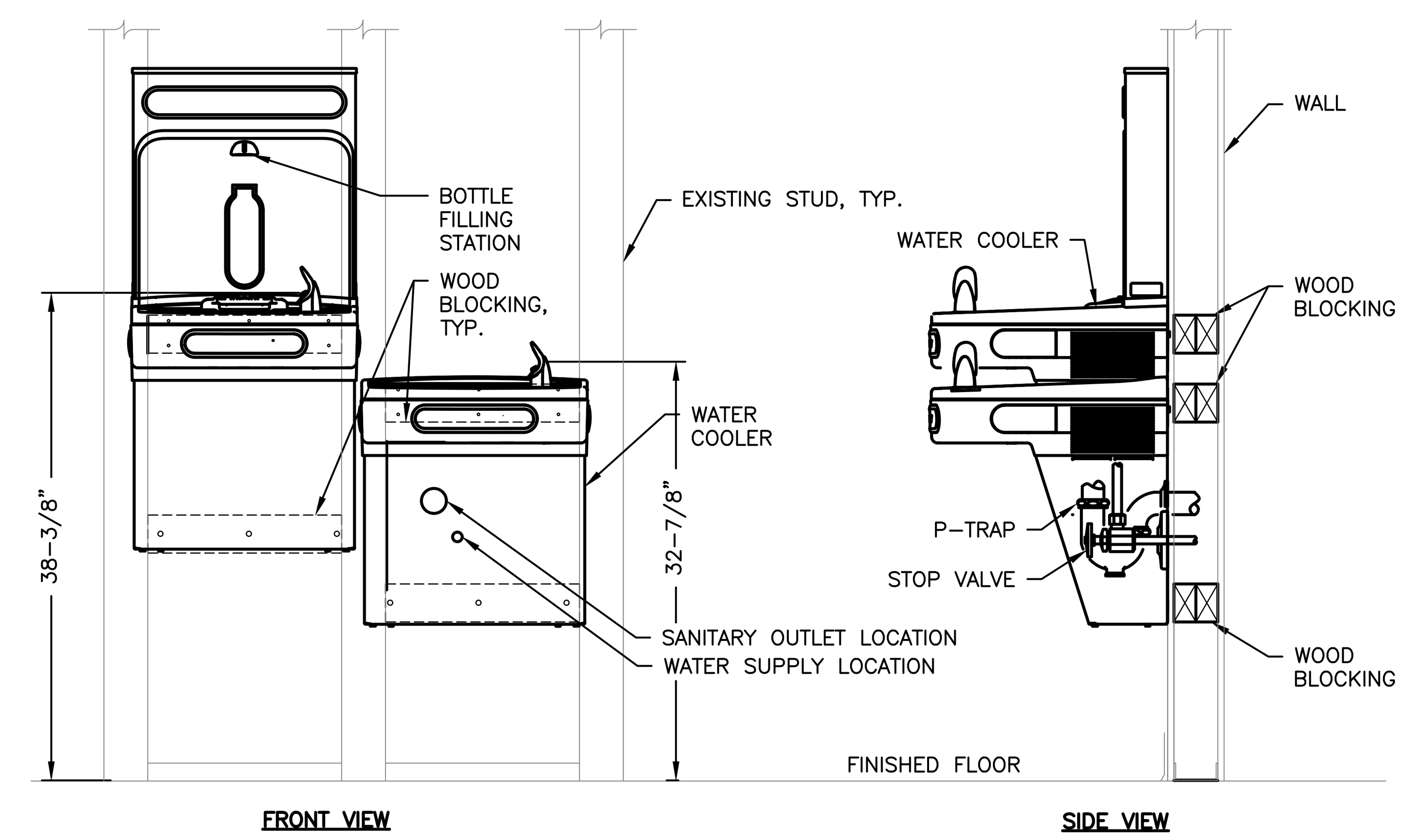
URINAL SUPPORT

NOT TO SCALE



LAVATORY ROUGH-IN

NOT TO SCALE



NOTES:
1. CONTRACTOR SHALL VERIFY DIMENSIONS FROM ROUGH IN DATA SHEETS AND SCHEDULED MOUNTING HEIGHTS.

ADA WATER COOLER INSTALLATION DETAIL

NOT TO SCALE

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DATE: 05-17-2016

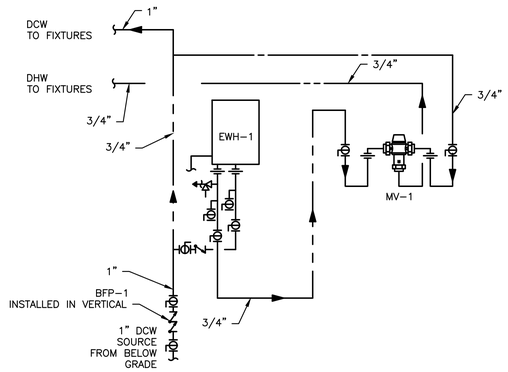
PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: N/A

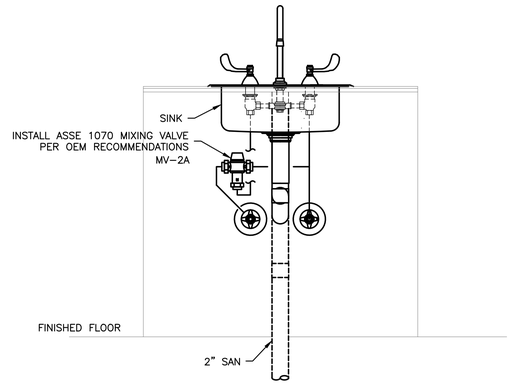
PLUMBING DETAILS

SHEET NO.: P5.01



WATER HEATER / BACKFLOW PREVENTER DETAIL

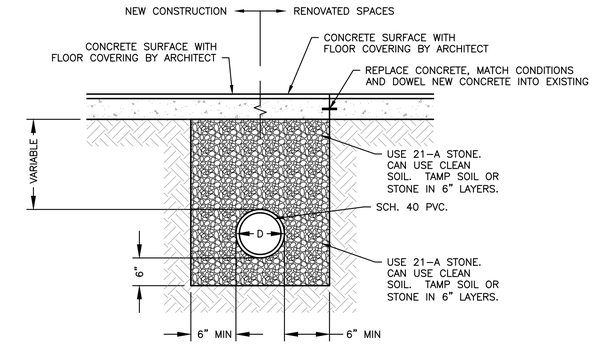
NOT TO SCALE



NOTE: INSTALLATION SHOWN IS SIMILAR FOR LAVATORIES AND OTHER FIXTURES.

ASSE 1070 MIXING VALVE INSTALLATION DETAIL

NOT TO SCALE



INSIDE PIPE BEDDING DETAIL

NOT TO SCALE

CO-1 SEE SCHEDULE FOR DETAILS

NOT TO SCALE

TRAP PRIMER CONNECTION DETAIL

NOT TO SCALE

FD-1 SEE SCHEDULE FOR DETAILS

NOT TO SCALE

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EXP./CLIENT NO: N/A

SCALE: N/A

PLUMBING DETAILS

SHEET NO.:
P5.02

DEMOLITION LEGEND

DESIGNATIONS – DEMOLITION PLANS:

- (dark dashed line) FIXTURES AND DEVICES SHOWN WITH DARK DASHED LINES ARE TO BE REMOVED OR RELOCATED. RETURN TO BUILDING STOCK DEVICES AND FIXTURES TO BE REMOVED.
- (light solid line) FIXTURES AND DEVICES SHOWN WITH LIGHT SOLID LINES ARE EXISTING TO REMAIN AND REMAIN OPERABLE.

DESIGNATIONS – NEW WORK PLANS:

- (dark solid line) FIXTURES AND DEVICES SHOWN WITH DARK SOLID LINES ARE NEW OR RELOCATED.
- (light solid line) FIXTURES AND DEVICES SHOWN WITH LIGHT SOLID LINES ARE EXISTING TO REMAIN AND REMAIN OPERABLE.

THE FOLLOWING ABBREVIATIONS APPLY TO ALL ELECTRICAL DEVICES WHERE INDICATED:

ETR = EXISTING TO REMAIN

GENERAL LEGEND

- CEILING OR WALL MOUNTED JUNCTION BOX
- MOTOR CONNECTION
- HEAVY DUTY SAFETY SWITCH
- PANELBOARD (FLUSH OR SURFACE MOUNTED)
- BRANCH CIRCUIT WIRING
- BRANCH CIRCUIT HOMERUN
- GROUND

NOTES: ALL MOUNTING HEIGHTS SHALL BE AS INDICATED IN THE LEGENDS OR INDICATED ON THE FLOOR PLANS. HEIGHT INDICATED ON FLOOR PLANS TAKE PRESIDENCE. (HEIGHT INDICATED IS TO CENTER OF THE DEVICE ABOVE FINISHED FLOOR).

ALL DEVICES SHALL BE RECESSED MOUNTED FLUSH IN THE WALL, CEILING, OR FLOOR UNLESS OTHERWISE NOTED.

POWER AND COMMUNICATIONS LEGEND

- DUPLEX RECEPTACLE (+18")
- RECEPTACLE ON EMERGENCY POWER
- LP-5 / G,C / +48":
  - PANEL NAME AND CIRCUIT NUMBER
  - DESCRIPTIONS:
    - C – MOUNTED 8" ABOVE COUNTER
    - G – GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLE
    - K – CLOCK HANGER RECEPTACLE
    - R – CORD REEL RECEPTACLE
    - T – TAMPER RESISTANT RECEPTACLE
    - U – RECEPTACLE WITH BUILT–IN USB CHARGER
    - W – WEATHERPROOF RECEPTACLE
  - MOUNTING HEIGHT

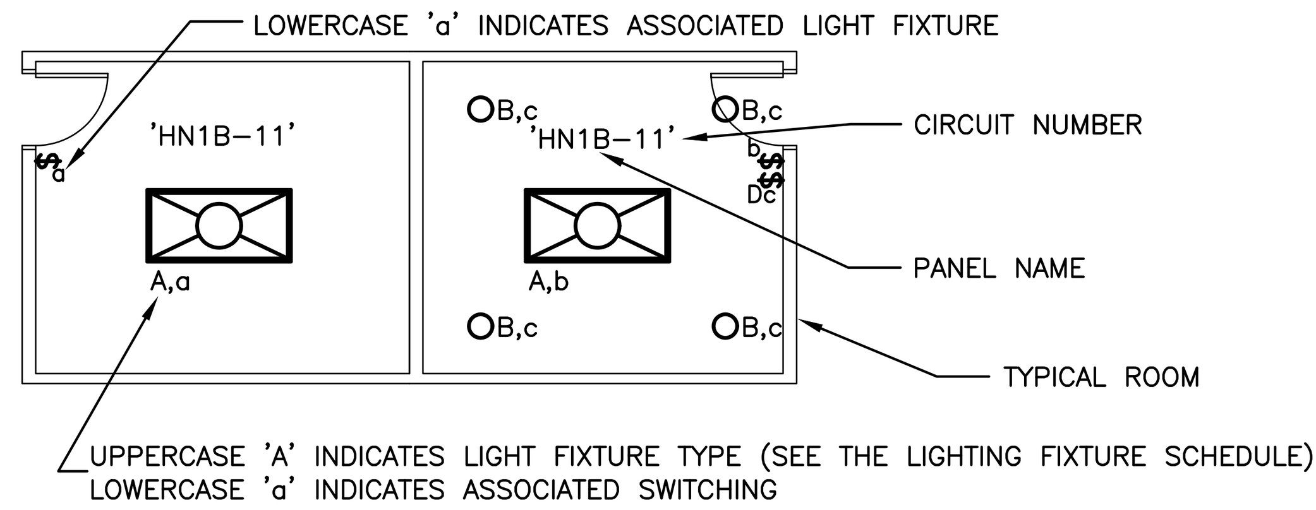
LIGHTING LEGEND

- 1'x4' LIGHT FIXTURE
- CEILING OR WALL MOUNTED EXIT LIGHT (NUMBER OF FACES AND DIRECTIONAL ARROWS AS INDICATED ON THE FLOOR PLANS)
- EMERGENCY LIGHT FIXTURE
- COMBINATION EXIT LIGHT AND EMERGENCY LIGHT FIXTURE
- LIGHT FIXTURE ON EMERGENCY POWER OR PROVIDED WITH EMERGENCY BATTERY BALLAST
- A,a: UPPERCASE 'A' INDICATES LIGHT FIXTURE TYPE (SEE THE LIGHTING FIXTURE SCHEDULE) LOWERCASE 'a' INDICATES ASSOCIATED SWITCHING
- SINGLE POLE SWITCH (+48")
- LOWERCASE 'a' INDICATES ASSOCIATED LIGHT FIXTURE(S)
- OS a: CEILING MOUNTED LINE–VOLTAGE DUAL TECHNOLOGY OCCUPANCY SENSOR, LOWERCASE 'a' INDICATES ASSOCIATED LIGHT FIXTURE(S)

FIRE SAFETY LEGEND

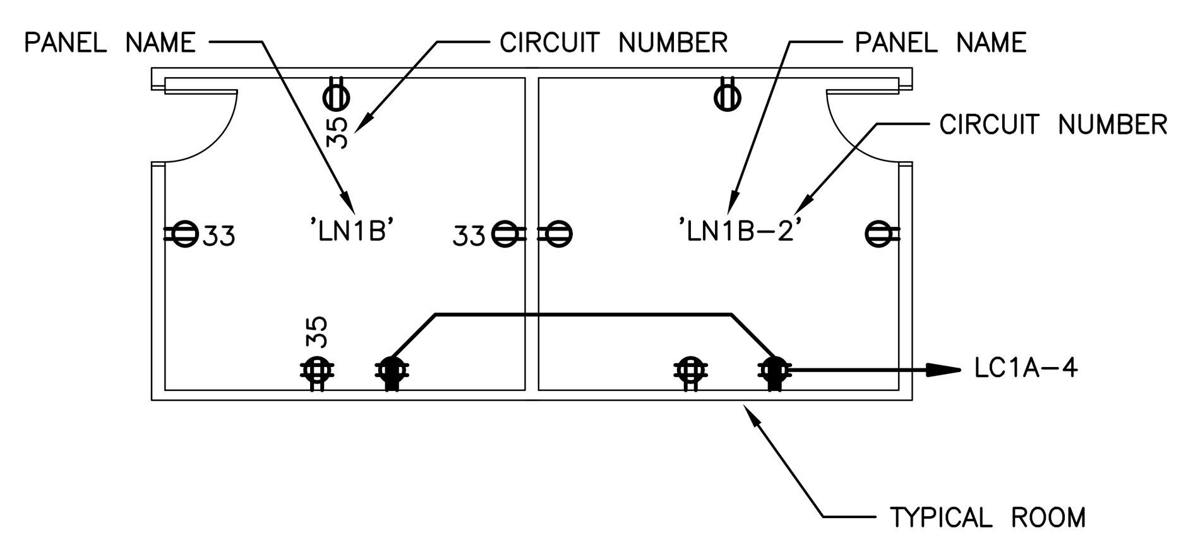
- F xx: WALL MOUNTED FIRE ALARM VISUAL SIGNALING DEVICE (+80" TO BOTTOM OF DEVICE OR 6" BELOW FINISHED CEILING, WHICHEVER IS LOWER) xx=CANDELA SETTING
- F xx: WALL MOUNTED FIRE ALARM AUDIO/VISUAL SIGNALING DEVICE (+80" TO BOTTOM OF DEVICE OR 6" BELOW FINISHED CEILING, WHICHEVER IS LOWER) xx=CANDELA SETTING
- F: FIRE ALARM PULL STATION (+48")
- S: CEILING MOUNTED SMOKE DETECTOR

CIRCUIT DESCRIPTIONS – LIGHTING



NOTES: CIRCUITING WILL BE SHOWN ON THE LIGHTING PLANS WHERE A CIRCUIT PROVIDES POWER TO WHITE LIGHT OR LIFE SAFETY POWER FIXTURES THAT ARE LOCATED THROUGHOUT THE ENTIRE SPACE. CIRCUITING MAY NOT BE SHOWN WHERE A CIRCUIT PROVIDES POWER TO FIXTURES WITHIN ROOMS ADJACENT TO EACH OTHER AS SHOWN ABOVE.

CIRCUIT DESCRIPTIONS – POWER



NOTES: CIRCUITING WILL BE SHOWN ON THE POWER PLANS WHERE A CIRCUIT PROVIDES POWER TO MULTIPLE ROOMS. CIRCUITING MAY NOT BE SHOWN WHERE A CIRCUIT PROVIDES POWER TO ONLY ONE ROOM AS SHOWN ABOVE.

GENERAL DEMOLITION NOTES

1. COORDINATE ALL ELECTRICAL UTILITY AND ELECTRICAL DISTRIBUTION SHUTDOWNS WITH OWNER AND ARCHITECT. ANY SHUT DOWNS NECESSARY TO ACHIEVE THE OBJECTIVE OF THIS DESIGN SHALL BE COMPLETED DURING "OFF HOURS" AND SHALL COMPLY WITH OWNER'S UTILITY SHUT DOWN POLICIES. A MINIMUM OF 72 HOURS NOTIFICATION (OR AS INDICATED IN THE SPECIFICATIONS) OF ANY POTENTIAL POWER OUTAGE IS REQUIRED.
2. CONTRACTOR IS RESPONSIBLE FOR ALL CUTTING, PATCHING AND DEMOLITION OF ALL BUILDING SYSTEMS PER THEIR MEANS–AND–METHODS AS NECESSARY TO PROVIDE THE DESIGN INDICATED. CONTRACTOR SHALL RESTORE ALL AREAS TO PREVIOUS CONDITION, OR REPLACE DAMAGED ITEMS WITH NEW ITEMS TO MATCH EXISTING.
3. CONTRACTOR SHALL COORDINATE EXISTING ELECTRICAL SYSTEM OPERATION AND DEMOLITION WITH SPECIFIC AREAS SERVED. EXISTING ELECTRICAL SYSTEMS SHALL REMAIN OPERATIONAL IF SERVING AN AREA OUTSIDE OF THE PROJECT BOUNDARY AND SHALL NOT BE REMOVED UNTIL THE ELECTRICAL SYSTEM CAN BE SERVED BY ANOTHER SOURCE.
4. INFORMATION PROVIDED ON THESE DRAWINGS HAVE BEEN TAKEN FROM DESIGN DRAWINGS AND FIELD OBSERVATIONS. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO PRICING AND COMMENCEMENT OF WORK.
5. PLANS MAY NOT REFLECT TOTAL EXTENT OF EXISTING INSTALLED CONDITIONS. WHERE EXISTING WALLS ARE DEMOLISHED, REMOVE ALL EXISTING ELECTRICAL DEVICES AND THEIR ASSOCIATED CONDUITS AND WIRING BACK TO THE NEAREST ACTIVE JUNCTION BOX OUTSIDE OF THE PROJECT LIMITS OR BACK TO THE POINT OF ORIGINATION. RE–ENERGIZE ALL EXISTING DEVICES THAT WERE INTERRUPTED DURING DEMOLITION. WHERE ENTIRE CIRCUITS ARE REMOVED, TURN THE CIRCUIT BREAKER OFF AND LABEL AS "SPARE".
6. PROVIDE FOR ANY AND ALL DEMOLITION WORK NECESSARY TO ACCOMMODATE ALL NEW CONSTRUCTION, INCLUDING ARCHITECTURAL, MECHANICAL, PLUMBING OR ELECTRICAL WORK.
7. CONTRACTOR SHALL REMOVE ALL CONDUIT AND WIRING ASSOCIATED WITH DEVICES AND EQUIPMENT TO BE REMOVED AND/OR RELOCATED UNLESS OTHERWISE NOTED. PROVIDE AND INSTALL ALL NECESSARY DEVICES, EQUIPMENT AND ASSOCIATED MATERIALS REQUIRED TO MAINTAIN SERVICE TO ALL "EXISTING TO REMAIN" DEVICES AND EQUIPMENT THAT MAY BE INTERRUPTED DURING DEMOLITION.
8. REFER TO ARCHITECTURAL PLANS FOR AREAS WHERE CEILING IS DEMOLISHED. REMOVE ALL LIGHTING FIXTURES AND ASSOCIATED CONDUIT AND WIRING FROM THESE LOCATIONS.
9. ALL LIGHTING FIXTURES DEMOLISHED SHALL BE RETURNED TO THE OWNER.

GENERAL ELECTRICAL NOTES

1. ALL WORK SHALL CONFORM TO THE REGULATIONS OF APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, ORDINANCES, AND CODES. ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST ADOPTED CODES AND OF THE AUTHORITY HAVING JURISDICTION.
2. DRAWINGS ARE CONSIDERED DIAGRAMMATIC AND INDICATE A GENERAL ARRANGEMENT OF WORK. REFER TO THE ARCHITECTURAL DRAWINGS FOR COORDINATION AND EXACT EQUIPMENT LOCATIONS.
3. VISIT THE PROJECT SITE AND INSPECT EXISTING SYSTEMS BEFORE BID IN ORDER TO ENSURE PROPER EVALUATION OF WORKING CONDITIONS AND LOCATION OF EXISTING EQUIPMENT.
4. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS AND ASSOCIATED FEES AND TAXES.
5. PROVIDE ALL MATERIAL AND EQUIPMENT NOT INDICATED AS EXISTING TO REMAIN IN THE CONTRACT DOCUMENTS. ALL MATERIAL SHALL BE NEW FREE FROM DEFECTS AND UL LISTED.
6. PROVIDE ALL SCAFFOLDING, RIGGING, HOISTING, AND SERVICES NECESSARY FOR ERECTION AND DELIVERY OF ANY EQUIPMENT.
7. INSTALL ALL WORK IN A NEAT AND WORKMANLIKE MANNER. INSTALL ALL NEW WORK WITH MINIMUM INTERFERENCE TO EXISTING SYSTEMS.
8. MAINTAIN A CLEAN WORK AREA AT ALL TIMES DURING CONSTRUCTION.
9. DO NOT CUT STRUCTURAL MEMBERS OR SUPPORTS WITHOUT THE APPROVAL OF THE ARCHITECT AND STRUCTURAL ENGINEER.
10. PROVIDE A MINIMUM ONE YEAR WARRANTY TO COVER ALL MATERIALS, EQUIPMENT, AND LABOR. WARRANTY SHALL START AFTER FINAL ACCEPTANCE BY THE OWNER AND IT SHALL COVER COSTS ASSOCIATED WITH ANY REPAIRS OR REPLACEMENTS CAUSED BY DEFECTIVE WORKMANSHIP OR FAULTY MATERIALS OR EQUIPMENT.
11. TEST ALL SYSTEMS AFTER INSTALLATION. SYSTEMS SHALL OPERATE AS DESIGNED AND INTENDED.
12. PROVIDE DEDICATED NEUTRALS FOR ALL CIRCUITS.
13. ALL DEVICES SHALL BE RECESSED MOUNTED FLUSH IN THE WALL, FLOOR, OR CEILING UNLESS OTHERWISE NOTED.
14. ALL MOUNTING HEIGHTS ARE INDICATED WITHIN THE LEGENDS UNLESS OTHERWISE INDICATED ON THE FLOOR PLANS.
15. CONTRACTOR SHALL X–RAY ANY NEW PENETRATIONS INTO AN EXISTING SLAB OR MASONRY WALL PRIOR TO CORING OR TRENCHING. COORDINATE X–RAY, CORING, AND TRENCHING WITH THE OWNER.

ELECTRICAL ABBREVIATIONS

A	AMPERE
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
AMP	AMPERE
ARCH	ARCHITECT/ARCHITECTURAL
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BFC	BELOW FINISHED CEILING
BRK	BREAKER
CIRC	CIRCUIT
CLG	CEILING
CCTV	CLOSED CIRCUIT TELEVISION
CU	CONDENSING UNIT
CORR	CORRIDOR
CT	CURRENT TRANSFORMER/COOLING TOWER
CUH	CABINET UNIT HEATER
DEMO	DEMOLITION
DISC	DISCONNECT
DIST	DISTRIBUTION
DS	DISCONNECT SWITCH
DWG	DRAWING
EC	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
EGC	EQUIPMENT GROUNDING CONDUCTOR
ELEC	ELECTRIC/ELECTRICAL
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
ENT	ELECTRICAL NONMETALLIC TUBING
EPO	EMERGENCY POWER OFF
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EX	EXISTING
FACP	FIRE ALARM CONTROL PANEL
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FLA	FULL LOAD AMPS
FSS	FUSED SAFETY SWITCH
FT	FOOT
GC	GENERAL CONTRACTOR
GEC	GROUNDING ELECTRODE CONDUCTOR
GEN	GENERATOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
HD	HEAVY DUTY
HID	HIGH INTENSITY DISCHARGE
HOA	HAND OFF AUTO
HP	HORSEPOWER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
HZ	HERTZ
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
JB	JUNCTION BOX
KO	KNOCK OUT
KVA	KILOVOLT–AMPERE
KW	KILOWATT

LFMC	LIQUIDTIGHT FLEXIBLE METAL CONDUIT
LFNC	LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT
LV	LOW VOLTAGE
MAX	MAXIMUM
MC	METAL–CLAB CABLE
MCA	MINIMUM CIRCUIT AMPACITY
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MIN	MINIMUM
MISC	MISCELLANEOUS
MLO	MAIN LUG ONLY
MOCP	MAXIMUM OVER CURRENT PROTECTION
MTS	MANUAL TRANSFER SWITCH
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFSS	NON–FUSED SAFETY SWITCH
NTS	NOT TO SCALE
#	NUMBER
OCPD	OVER CURRENT PROTECTION DEVICE
P	POLE
PDU	POWER DISTRIBUTION UNIT
PF	POWER FACTOR
PFF	PROVISION FOR FUTURE
PH	PHASE
PNL	PANEL
PSI	POUNDS PER SQUARE INCH
PVC	RIGID POLYVINYL CHLORIDE CONDUIT
PWR	POWER
ø	PHASE
RIF	RADIO INTERFERENCE FILTER
RLA	RUNNING LOAD AMPS
RM	ROOM
RMC	RIGID METAL CONDUIT
RTU	ROOF TOP UNIT
SPEC	SPECIFICATION
SS	SURGE SUPPRESSION
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYS	SYSTEM
TELE	TELEPHONE
TEMP	TEMPERATURE
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSER
TYP	TYPICAL
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORY
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT
VA	VOLT AMPERE
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
W	WATT/WEATHER PROOF
WP	WEATHERPROOF

MEP DESIGN SUMMARY

PROJECT INFORMATION

PROJECT NAME:	FARMERS MARKET RESTROOM RENOVATION
ADDRESS:	345 SOUTH MAIN STREET HARRISONBURG, VA. 22801
PROPOSED USE:	OFFICE AND PUBLIC RESTROOMS
OWNER:	CITY OF HARRISONBURG
OWNER CONTACT:	ADAM WRIGHT
PHONE:	540–560–9455
VE PROJ. NO.:	10895–3

APPLICABLE CODES

BUILDING CODE:	VIRGINIA REHABILITATION CODE: 2012 WORK COMPLIANCE METHOD
MECHANICAL CODE:	VIRGINIA MECHANICAL CODE: 2012
PLUMBING CODE:	VIRGINIA PLUMBING CODE: 2012
ELECTRICAL CODE:	NFPA 70, 2011 NATIONAL ELECTRICAL CODE
ACCESSIBILITY CODE:	ICC/ANSI A117.1 2009 STANDARDS ON ACCESSIBLE AND USABLE BUILDING AND FACILITIES
GAS CODE:	VIRGINIA FUEL GAS CODE: 2012

PROJECT TEAM

PROJECT MANAGER:	PHIL GENTRY
PROJECT TEAM:	JOHN SOLDANO – HVAC ENGINEER MATT SHOCKEY – PLUMBING ENGINEER KEVIN KLINE – ELECTRICAL ENGINEER TED ENOSAKI – STRUCTURAL ENGINEER TIM HOUSDEN – ELECTRICAL DESIGNER

DRAWING LIST

FARMERS MARKET RESTROOM RENOVATION

345 SOUTH MAIN STREET
HARRISONBURG VIRGINIA, 22801

VALLEY | ENGINEERING
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3231 PEOPLES DRIVE
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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016

PROJECT NO: 10895-3

EXP./CLIENT NO: N/A

SCALE: NTS

ELECTRICAL LEGEND, ABBREVIATIONS, AND NOTES

SHEET NO.: E0.01

ELECTRICAL SPECIFICATIONS

1. GENERAL:

1.A. VOLTAGE CHARACTERISTICS:

1.A.1. OPERATING VOLTAGE CHARACTERISTICS SHALL BE 277/480V AND/OR 120/208V, 1ø AND/OR 3ø, 3 WIRE AND/OR 4 WIRE, WITH A GROUNDED NEUTRAL, AND 60 HERTZ. VERIFY EXACT REQUIREMENTS WITH ALL EQUIPMENT.

1.B. COORDINATION:

1.B.1. COORDINATE ARRANGEMENT, MOUNTING, AND SUPPORT OF ELECTRICAL EQUIPMENT TO ALLOW MAXIMUM POSSIBLE HEADROOM UNLESS SPECIFIC MOUNTING HEIGHTS THAT REDUCE HEADROOM ARE INDICATED, TO PROVIDE EASE OF DISCONNECTING THE EQUIPMENT WITH MINIMUM INTERFERENCE TO OTHER INSTALLATIONS, TO ALLOW RIGHT OF WAY FOR PIPING, DUCTWORK, AND OTHER SYSTEMS REQUIRING SLOPE AND RIGHT OF WAY INSTALLATION, AND SO CONNECTING RACEWAYS, CABLES, WIREWAYS, CABLE TRAYS, AND BUSWAYS WILL BE CLEAR OF OBSTRUCTIONS AND OF THE WORKING AND ACCESS SPACE OF OTHER EQUIPMENT.
1.B.2. COORDINATE INSTALLATION OF REQUIRED SUPPORTING DEVICES AND SET SLEEVES IN CAST-IN-PLACE CONCRETE, MASONRY WALLS, AND OTHER STRUCTURAL COMPONENTS AS THEY ARE CONSTRUCTED.
1.B.3. PROVIDE AND COORDINATE THE LOCATION OF ACCESS PANELS AND DOORS FOR ELECTRICAL ITEMS THAT ARE BEHIND FINISHED SURFACES OR OTHERWISE CONCEALED.

2. CONDUCTORS, RACEWAYS, AND BOXES:

2.A. CONDUCTORS:

2.A.1. ALL CONDUCTORS SHALL BE COPPER. CONDUCTORS SHALL BE SOLID FOR #10AWG AND SMALLER AND STRANDED FOR #8AWG AND LARGER. MINIMUM CONDUCTOR SIZE SHALL BE #12AWG.
2.A.2. CONDUCTOR INSULATION SHALL BE THHN-THWN.
2.A.3. CONDUCTORS FOR FEEDERS AND BRANCH CIRCUITS SHALL BE SINGLE CONDUCTORS IN A RACEWAY.
2.A.4. CONDUCTORS AT DEVICES AND EQUIPMENT SHALL BE PROVIDED WITH ADEQUATE SLACK TO MAKE FINAL CONNECTIONS.
2.A.5. BRANCH CIRCUITS THAT ARE OVER 100 FEET IN LENGTH FROM THE PANEL TO THE FIRST OUTLET SHALL HAVE THE CONDUCTORS ONE SIZE LARGER THAN INDICATED IN THE PANEL SCHEDULE.
2.A.6. THE QUANTITY OF CONDUCTORS MAY NOT BE INDICATED FOR ALL CIRCUITS. PROVIDE ALL CONDUCTORS AS REQUIRED FOR THE PROPER FUNCTION OF THE SYSTEM WHETHER INDICATED IN THE PANEL SCHEDULE OR NOT.

2.B. RACEWAYS:

2.B.1. RACEWAYS FOR INTERIOR APPLICATIONS SHALL BE ELECTRICAL METALLIC TUBING (EMT) WITH A MINIMUM SIZE OF 3/4" UNLESS OTHERWISE NOTED OR AS REQUIRED BY THE SPACE.
2.B.2. RACEWAYS FOR EXTERIOR APPLICATIONS SHALL BE PVC SCHEDULE 40 WITH A MINIMUM SIZE OF 1" UNLESS OTHERWISE NOTED OR AS REQUIRED BY THE SPACE.
2.B.3. EXPOSED RACEWAYS OR RACEWAYS SUBJECT TO PHYSICAL DAMAGE SHALL BE RIGID STEEL CONDUIT.
2.B.4. CONCEAL ALL RACEWAYS IN FINISHED WALLS, CEILINGS, AND FLOORS UNLESS OTHERWISE NOTED.
2.B.5. ANY EXPOSED RACEWAY SHALL BE RUN PARALLEL WITH OR AT RIGHT ANGLES TO THE BUILDING STRUCTURE, WALLS, OR PARTITIONS.
2.B.6. RACEWAY SUPPORTS SHALL BE STEEL HANGERS, CLAMPS, AND ASSOCIATED FITTINGS DESIGNED FOR TYPES AND SIZES OF RACEWAY TO BE SUPPORTED. SECURE ALL SUPPORTS TO THE BUILDING STRUCTURE. INSTALL AND SPACE SUPPORTS FOR RACEWAYS AS REQUIRED BY THE NEC UNLESS OTHERWISE NOTED.
2.B.7. EMT CONDUIT FITTINGS SHALL BE STEEL SET-SCREW.
2.B.8. MAINTAIN INDICATED FIRE RATING OF WALLS, PARTITIONS, CEILINGS, AND FLOORS AT RACEWAY PENETRATIONS. INSTALL SLEEVES AND SEAL WITH APPROPRIATE FIRESTOP MATERIALS TO MAINTAIN THE EXISTING RATING OF THE ASSEMBLY.
2.B.9. USE A MAXIMUM OF 72 INCHES OF TYPE HCF FLEXIBLE CONDUIT FOR FINAL CONNECTIONS TO LIGHT FIXTURES, EQUIPMENT SUBJECT TO VIBRATION OR MOVEMENT, MOTORS, AND TRANSFORMERS.
2.B.10. INSTALL A PULL STRING IN ALL EMPTY RACEWAYS.
2.B.11. CUT RACEWAY ENDS SQUARE AND REAM SMOOTH. DRAW UP RACEWAY ENDS TIGHT WITH THE CONDUIT CONNECTORS AND COUPLINGS.
2.B.12. WHERE RACEWAYS PENETRATE AN EXTERIOR WALL OR THE ROOF AND GO FROM AN INTERIOR SPACE TO AN EXTERIOR SPACE THOSE RACEWAYS SHALL BE SEATED TO PREVENT THE CIRCULATION OF WARM AIR TO A COLDER SECTION OF THE RACEWAY.

2.C. BOXES:

2.C.1. OUTLET BOXES SHALL BE RECESSED MOUNTED UNLESS OTHERWISE NOTED.
2.C.2. OUTLET BOXES SHALL BE CODE GAUGE STEEL AND OF THE SIZE INDICATED AS THE DRAWINGS OR AS REQUIRED FOR THE SPECIFIC CONDITIONS.
2.C.3. JUNCTION AND PULL BOXES SHALL GENERALLY BE LOCATED IN UNFINISHED SPACES AND ABOVE THE CEILING. PROVIDE PULL BOXES WHERE REQUIRED BY THE NEC AND WHEREVER NECESSARY TO FACILITATE THE PULLING OF CONDUCTORS. COVERS OF JUNCTION AND PULL BOXES SHALL BE ACCESSIBLE.
2.C.4. SET ALL BOXES SQUARE AND TRUE WITH ALL BUILDING FINISHES.

3. GROUNDING AND BONDING:

3.A. CONDUCTORS:

3.A.1. BOTH INSULATED AND BARE CONDUCTORS SHALL BE COPPER. INSULATION FOR INSULATED GROUNDING CONDUCTORS SHALL BE GREEN IN COLOR. CONDUCTORS SHALL BE SOLID FOR #8AWG AND SMALLER AND STRANDED FOR #6AWG AND LARGER.
3.A.2. INSTALL INSULATED EQUIPMENT GROUNDING CONDUCTORS WITH ALL FEEDERS AND BRANCH CIRCUITS. EQUIPMENT GROUNDING CONDUCTOR SHALL BE SIZED IN ACCORDANCE WITH THE OVERCURRENT PROTECTIVE DEVICE SERVING THAT FEEDER OR BRANCH CIRCUIT.

3.B. MISCELLANEOUS:

3.B.1. GROUNDING BUS SHALL BE COPPER. BUS SHALL BE RECTANGULAR WITH A 1/4 BY 2 INCH CROSS SECTION UNLESS OTHERWISE NOTED.
3.B.2. GROUND RODS SHALL BE COPPER-CLAD AND 3/4 INCH BY 10 FEET IN SIZE UNLESS OTHERWISE NOTED.

4. IDENTIFICATION:

4.A. CONDUCTORS:

4.A.1. ALL CONDUCTORS 600V OR LESS SHALL BE IDENTIFIED FOR PHASE AND VOLTAGE LEVEL BY FOLLOWING COLORS UNLESS THE EXISTING FACILITIES IDENTIFICATION COLORS ARE DIFFERENT IN WHICH THOSE TAKE PRECEDENCE:

	PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND
208/120V	BLACK	RED	BLUE	WHITE	GREEN
480/277V	BROWN	ORANGE	YELLOW	GRAY	GREEN

4.B. RACEWAYS AND JUNCTION BOXES:

4.B.1. RACEWAYS FOR CIRCUITS 600V OR LESS SHALL BE IDENTIFIED BY THE FOLLOWING COLORS UNLESS THE EXISTING FACILITIES IDENTIFICATION COLORS ARE DIFFERENT IN WHICH THOSE TAKE PRECEDENCE:

NORMAL POWER	SILVER
LIFE SAFETY POWER	YELLOW
CRITICAL POWER	ORANGE
EQUIPMENT POWER	GREEN
FIRE ALARM	RED

4.B.2. JUNCTION AND PULL BOX COVERS SHALL BE IDENTIFIED WITH PERMANENT MARKER IN LEGIBLE WRITING INDICATING THE SYSTEM VOLTAGE, BRANCH OF POWER, PANEL NAME, AND CIRCUIT NUMBER IF APPLICABLE.

4.C. EQUIPMENT:

4.C.1. EQUIPMENT SHALL BE IDENTIFIED WITH AN ENGRAVED, SELF-ADHESIVE LABEL INDICATING THE EQUIPMENT NAME, AMPERAGE, VOLTAGE, PHASE, BRANCH THE EQUIPMENT IS ON, WHERE THE EQUIPMENT IS FED FROM, AND THE FACILITY PHASING COLORS.
4.C.2. EQUIPMENT TO BE LABELED SHALL INCLUDE BUT NOT BE LIMITED TOO: PANELBOARDS, TRANSFORMERS, SWITCHGEAR, SWITCHBOARDS, SUBSTATIONS, MOTOR CONTROL CENTERS, ENCLOSED SWITCHES, ENCLOSED BREAKERS, TRANSFER SWITCHES, UPS EQUIPMENT, AND GENERATORS.

5. EQUIPMENT:

5.A. PANELBOARDS:

5.A.1. ENCLOSURES SHALL BE FLUSH AND/OR SURFACE MOUNTED CABINETS AS INDICATED ON THE FLOOR PLANS.
5.A.2. ENCLOSURES SHALL BE NEMA 1 FOR INDOOR DRY AND CLEAN LOCATIONS, NEMA 3R FOR OUTDOOR LOCATIONS, AND NEMA 4X STAINLESS STEEL FOR KITCHEN AREAS.
5.A.3. ENCLOSURES, PANELS, AND TRIM SHALL BE STEEL.
5.A.4. PHASE, NEUTRAL, AND GROUND BUSES SHALL BE COPPER.
5.A.5. CONDUCTOR CONNECTORS SHALL BE MECHANICAL TYPE LUGS SUITABLE FOR COPPER CONDUCTORS
5.A.6. PANELBOARDS SHALL HAVE A FULLY RATED SHORT-CIRCUIT CURRENT RATING.
5.A.7. PANELBOARD CIRCUIT BREAKERS SHALL BE MOLDED CASE, THERMAL-MAGNETIC, BOLT-ON TYPE CIRCUIT BREAKERS.
5.A.8. PROVIDE A TYPEWRITTEN DIRECTORY CARD INSIDE EACH PANELBOARD DOOR.
5.A.9. PANELBOARDS SHALL BE MANUFACTURED BY SQUARE D OR GE. PANELBOARDS SHALL MATCH THE EXISTING BASE BUILDING DISTRIBUTION EQUIPMENT MANUFACTURER.

5.B. TRANSFORMERS:

5.B.1. TRANSFORMERS SHALL BE VENTILATED DRY-TYPE TRANSFORMERS.
5.B.2. TRANSFORMERS SHALL BE PROVIDED WITH A COPPER COIL.
5.B.3. TRANSFORMERS SHALL BE PROVIDED WITH TWO (2) 2-1/2% TAPS ABOVE AND FOUR (4) 2-1/2% TAPS BELOW NORMAL FULL CAPACITY.
5.B.4. TRANSFORMERS SHALL BE PROVIDED WITH A 220°C INSULATION SYSTEM WITH A MAXIMUM RISE OF 150°C ABOVE A 40°C AMBIENT TEMPERATURE.
5.B.5. TRANSFORMERS SHALL BE ENERGY EFFICIENT AND COMPLY WITH NEMA TP 1 AND NEMA TP 2 STANDARDS.
5.B.6. TRANSFORMERS SHALL HAVE LOW SOUND LEVELS AND COMPLY WITH NEMA ST 20.
5.B.7. TRANSFORMERS SHALL BE PROVIDED WITH ELECTROSTATIC SHIELDING AND FUNGUS PROOFING.
5.B.8. TRANSFORMERS SHALL BE MANUFACTURED BY SQUARE D, GE, OR POWERSMITHS. TRANSFORMERS SHALL MATCH THE EXISTING BASE BUILDING DISTRIBUTION EQUIPMENT MANUFACTURER.

5.C. ENCLOSED SWITCHES AND CIRCUIT BREAKERS:

5.C.1. ENCLOSED SWITCHES SHALL BE HEAVY DUTY, SINGLE THROW, AND HORSEPOWER RATED WITH A LOCKABLE HANDLE THAT IS INTERLOCKED WITH THE COVER IN THE CLOSED POSITION.
5.C.2. ENCLOSED CIRCUIT BREAKERS SHALL BE MOLDED CASE, THERMAL-MAGNETIC TYPE CIRCUIT BREAKERS.
5.C.3. CONDUCTOR CONNECTORS SHALL BE MECHANICAL TYPE LUGS SUITABLE FOR COPPER CONDUCTORS.
5.C.4. ENCLOSED SWITCHES AND CIRCUIT BREAKERS SHALL BE PROVIDED WITH EQUIPMENT GROUND AND NEUTRAL BARS AS REQUIRED.
5.C.5. ENCLOSURES SHALL BE NEMA 1 FOR INDOOR DRY AND CLEAN LOCATIONS, NEMA 3R FOR OUTDOOR LOCATIONS, AND NEMA 4X STAINLESS STEEL FOR KITCHEN AREAS.
5.C.6. ENCLOSED SWITCHES AND CIRCUIT BREAKERS SHALL BE MANUFACTURED BY SQUARE D OR GE. ENCLOSED SWITCHES AND CIRCUIT BREAKERS SHALL MATCH THE EXISTING BASE BUILDING DISTRIBUTION EQUIPMENT MANUFACTURER.

5.D. FUSES:

5.D.1. FUSES FOR FEEDERS SHALL BE CLASS RK1 TIME DELAY CARTRIDGE TYPE FUSES.
5.D.2. FUSES FOR MOTOR BRANCH CIRCUITS AND ALL OTHER BRANCH CIRCUITS SHALL BE CLASS RK5 TIME DELAY CARTRIDGE TYPE FUSES.
5.D.3. FUSES SHALL BE MANUFACTURED BY COOPER BUSSMANN, FERRAZ SHAWMUT, OR LITTLEFUSE.

5.E. MISCELLANEOUS:

5.E.1. EQUIPMENT SHALL BE PROVIDED WITH TERMINATION CONNECTIONS RATED AT 75°C.
5.E.2. ELECTRICAL EQUIPMENT SHALL BE FIELD MARKED WITH A WARNING LABEL TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARDS.
5.E.3. DRAWINGS INDICATE MAXIMUM DIMENSIONS FOR EQUIPMENT INCLUDING CLEARANCES BETWEEN EQUIPMENT AND ADJACENT SURFACES AND OTHER ITEMS. COMPLY WITH INDICATED MAXIMUM DIMENSIONS.
5.E.4. MAINTAIN REQUIRED WORKSPACE CLEARANCES AND REQUIRED CLEARANCES FOR EQUIPMENT ACCESS DOORS AND PANELS.

6. WIRING DEVICES:

6.A. GENERAL:

6.A.1. ALL DEVICES SHALL BE MANUFACTURED BY COOPER, HUBBELL, LEVITON, OR PASS & SEYMOUR.
6.A.2. WIRING DEVICES CONNECTED TO NORMAL POWER SHALL BE IVORY IN COLOR UNLESS OTHERWISE INDICATED BY THE ARCHITECT OR OWNER. WIRING DEVICES CONNECTED TO EMERGENCY POWER SHALL BE RED IN COLOR.
6.A.3. DEVICES COVERPLATES SHALL BE BRUSHED STAINLESS STEEL UNLESS OTHERWISE INDICATED BY THE ARCHITECT OR OWNER. DEVICE COVERPLATES SHALL BE ENGRAVED WITH THE PANEL NAME AND CIRCUIT NUMBER.
6.A.4. ALL WIRING DEVICES SHALL BE CAPABLE OF BEING GANGED TOGETHER WHERE SHOWN ON THE FLOOR PLANS.
6.A.5. KEEP DEVICE BOXES FREE OF PLASTER, DRYWALL JOINT COMPOUND, MORTAR, CEMENT, CONCRETE, DUST, PAINT, AND OTHER MATERIAL THAT MAY CONTAMINATE THE RACEWAY SYSTEM, CONDUCTORS, AND CABLES.
6.A.6. INSTALL DEVICE BOXES IN BRICK OR BLOCK WALLS SO THAT THE COVER PLATE DOES NOT CROSS A JOINT UNLESS THE JOINT IS TROWELED FLUSH WITH THE FACE OF THE WALL.
6.A.7. INSTALL WIRING DEVICES AFTER ALL WALL PREPARATION, INCLUDING PAINTING, IS COMPLETE.

6.B. RECEPTACLES:

6.B.1. RECEPTACLES SHALL BE 20A, 125V GROUNDING TYPE.
6.B.2. RECEPTACLES SHALL BE HOSPITAL GRADE.
6.B.3. SPECIAL NEMA RECEPTACLES SPECIFICATION SHALL BE SPECIFICATION GRADE SIMPLEX OUTLETS.
6.B.4. INSTALL GROUND PIN OF VERTICALLY MOUNTED RECEPTACLES UP, AND ON HORIZONTALLY MOUNTED RECEPTACLES TO THE RIGHT.

6.C. SWITCHES:

6.C.1. SWITCHES SHALL BE 20A, AND EITHER 120V OR 277V GROUNDING TYPE.
6.C.2. SWITCHES SHALL BE SPECIFICATION GRADE.
6.C.3. DIMMER SWITCHES SHALL BE CONTINUOUSLY ADJUSTABLE TOGGLE SWITCH TYPE DIMMING SWITCHES. WHEN USED FOR FLUORESCENT AND LED LAMPS DIMMER SWITCHES SHALL BE COMPATIBLE WITH THE SUPPLIED BALLASTS AND DRIVERS.
6.C.4. COORDINATE THE LIGHT SWITCH LOCATIONS WITH DOOR SWINGS. SWITCHES SHALL BE INSTALLED ON THE LATCH SIDE OF THE DOOR AS CLOSE TO THE FRAME AS POSSIBLE.

6.D. OCCUPANCY SENSORS:

6.D.1. WALL MOUNTED DUAL TECHNOLOGY AUTOMATIC WALL SWITCH OCCUPANCY SENSORS SHALL BE WATTSTOPPER #DSW-301.
6.D.2. CEILING MOUNTED LINE-VOLTAGE DUAL TECHNOLOGY OCCUPANCY SENSORS SHALL BE WATTSTOPPER #DT-355.
6.D.3. CEILING MOUNTED LOW-VOLTAGE DUAL TECHNOLOGY OCCUPANCY SENSORS SHALL BE WATTSTOPPER #DT-305. PROVIDE WATTSTOPPER POWER PACK #BZ-150 FOR USE WITH THE LOW-VOLTAGE OCCUPANCY SENSORS.

7. LIGHTING:

7.A. FIXTURES:

7.A.1. PROVIDE A COMPLETE SYSTEM OF LIGHTING FIXTURES, ACCESSORIES, AND SUPPORTS AS SPECIFIED IN THE LIGHTING FIXTURE SCHEDULE AND AS SHOWN ON THE DRAWINGS.
7.A.2. COORDINATE THE LIGHTING FIXTURE LAYOUT WITH THE ARCHITECTURAL REFLECTED CEILING PLAN. ALL LIGHTING FIXTURES MOUNTED IN LAY-IN CEILING TILES SHALL BE LOCATED IN THE CENTER OF THE TILE UNLESS OTHERWISE DIRECTED BY THE ENGINEER OR ARCHITECT. SET LIGHT FIXTURES LEVEL, PLUMB, AND SQUARE WITH CEILINGS AND WALLS.
7.A.3. LIGHTING FIXTURES SUPPORT WIRES SHALL BE 12 GAUGE ZINC-COATED STEEL.

7.B. LAMPS:

7.B.1. PROVIDE RAPID-START LOW MERCURY LAMPS FOR ALL LIGHT FIXTURES.
7.B.2. LAMPS SHALL HAVE A MINIMUM COLOR TEMPERATURE OF 3500K UNLESS OTHERWISE SPECIFIED IN THE LIGHTING FIXTURE SCHEDULE.

7.C. BALLASTS:

7.C.1. BALLASTS FOR T5, T8, AND CFL LAMPS SHALL BE ELECTRONIC PROGRAMMED RAPID-START BALLASTS WITH A THD OF LESS THAN 10 PERCENT.
7.C.2. PROVIDE ELECTRONIC BALLASTS FOR DIMMER CONTROLLED LIGHTING FIXTURES THAT ARE COMPATIBLE WITH THE SUPPLIED DIMMER SWITCH.
7.C.3. PROVIDE 0°F ELECTRONIC BALLASTS FOR ALL EXTERIOR LIGHT FIXTURES.

8. LOW VOLTAGE SYSTEMS:

8.A. TELECOMMUNICATIONS

8.A.1. PROVIDE A RECESSED BOX WITH A 3/4" EMPTY CONDUIT WITH PULL STRING STUBBED INTO THE ACCESSIBLE CEILING SPACE FOR ALL TELECOMMUNICATIONS OUTLETS.
8.A.2. CONCEAL ALL TELECOMMUNICATION RACEWAYS AND WIRING IN FINISHED WALLS, CEILINGS, AND FLOORS UNLESS OTHERWISE NOTED.

9. FIRE ALARMS:

9.A. PART ONE:

9.A.1. "PROVIDE" MEANS FURNISH AND INSTALL. CONTRACTOR IS RESPONSIBLE FOR A COMPLETE AND OPERATING SYSTEM. DIFFERENCES AND/OR CONFLICTS BETWEEN CONTRACT DRAWING AND SPECIFICATION & SHOP DRAWINGS, SHALL BE CALLED TO THE BUILDERS ATTENTION. IF DIFFERENCES AND/OR CONFLICTS ARE NOT NOTED TO BUILDERS PRIOR TO CONTRACT, BUILDER SHALL DETERMINE GOVERNING CONDITION AND SUB-CONTR. SHALL PERFORM WORK AT NO ADDITIONAL COST.

9.B. PART TWO - SUMMARY:

9.B.1. SYSTEM DESCRIPTION: NONCODED, UL-CERTIFIED ADDRESSABLE SYSTEM; MULTIPLEXED SIGNAL TRANSMISSION, DEDICATED TO FIRE ALARM SERVICE ONLY.

9.B.2. QUALITY ASSURANCE:
9.B.2.1. QUALITY STANDARD: NFPA 72
9.B.2.2. THE INSTALLER SHALL BE NICET CERTIFIED AS A FIRE ALARM TECHNICIAN.

9.B.3. SYSTEMS OPERATIONAL DESCRIPTION:
A. SIGNAL INITIATION FROM:
1. MANUAL STATIONS
2. HEAT DETECTORS
3. FLAME DETECTORS
4. SMOKE DETECTORS
5. DUCT SMOKE DETECTORS.
6. VERIFIED AUTOMATIC ALARM OPERATION OF SMOKE DETECTORS.
7. AUTOMATIC SPRINKLER SYSTEM WATER FLOW.
8. HEAT DETECTORS IN ELEVATOR SHAFT AND PIT.
9. FIRE-EXTINGUISHING SYSTEM OPERATION.
10. FIRE STANDPIPE SYSTEM WATER FLOW.

B. SIGNAL INITIATES THE FOLLOWING ACTIONS:
1. CONTINUOUSLY OPERATE ALARM NOTIFICATION APPLIANCES.
2. IDENTIFY ALARM AT THE FIRE ALARM CONTROL UNIT.
3. TRANSMIT AN ALARM SIGNAL TO THE REMOTE ALARM RECEIVING STATION.
4. UNLOCK ELECTRIC DOOR LOCKS IN DESIGNATED EGRESS PATHS.
5. RELEASE FIRE AND SMOKE DOORS HELD OPEN BY MAGNETIC DOOR HOLDERS.
6. ACTIVATE ALARM COMMUNICATION SYSTEM.
7. SWITCH HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT CONTROLS TO FIRE-ALARM MODE.
8. ACTIVATE SMOKE-CONTROL SYSTEM (SMOKE MANAGEMENT) AT FIREFIGHTER SMOKE CONTROL SYSTEM PANEL.
9. CLOSE SMOKE DAMPERS IN AIR DUCTS FOR DESIGNATED AIR CONDITIONING SYSTEMS.
10. RECORD EVENTS IN THE SYSTEM MEMORY.

C. SUPERVISORY SIGNAL INITIATION BY:
1. VALVE SUPERVISORY SWITCH.
2. LOW AIR-PRESSURE SWITCH OF A DRY-PIPE SPRINKLER SYSTEM.
3. ELEVATOR SHUNT-TRIP SUPERVISION.

D. TROUBLE SIGNAL INITIATION BY:
1. OPEN CIRCUITS, SHORTS, AND GROUNDS, IN DESIGNATED CIRCUITS.
2. OPENING, TAMPERING WITH, OR REMOVING ALARM-INITIATING AND SUPERVISORY SIGNAL-INITIATING DEVICES.
3. LOSS OF PRIMARY POWER AT FIRE-ALARM CONTROL UNIT.
4. GROUND OR A SINGLE BREAK IN FIRE-ALARM CONTROL UNIT INTERNAL CIRCUITS.
5. ABNORMAL AC VOLTAGE AT THE FIRE-ALARM CONTROL UNIT.
6. BREAK IN STANDBY BATTERY CIRCUIT.
7. FAILURE OF BATTERY CHARGING.
8. ABNORMAL POSITION OF ANY SWITCH AT THE FIRE-ALARM CONTROL UNIT OR ANNUNCIATOR.
9. LOW AIR-PRESSURE SWITCH OPERATION ON A DRY-PIPE OR PREACTION SPRINKLER SYSTEM.

E. SYSTEM TROUBLE AND SUPERVISORY SIGNAL ACTIONS: INITIATE NOTIFICATION APPLIANCE AND ANNUNCIATE AT FIRE-ALARM CONTROL UNIT.

2.4 PRODUCTS
A. FIRE-ALARM CONTROL UNIT: MODULAR, POWER-LIMITED DESIGN WITH ELECTRONIC MODULES, ADDRESSABLE INITIATION DEVICES.
1. ALPHANUMERIC LIQUID-CRYSTAL DISPLAY WITH SYSTEM CONTROLS AND KEYPAD.
B. MANUAL FIRE ALARM BOXES: DOUBLE ACTION
C. SYSTEM SMOKE DETECTORS: BASE MOUNTED, SELF-RESTORING, WITH INTEGRAL VISUAL-INDICATING LIGHT.
D. NOTIFICATION APPLIANCES:
1. CHIMES: HIGH LEVEL OUTPUT.
2. HORNS: ELECTRIC-VIBRATING-POLARIZED TYPE, 24-V DC.
3. VISUAL ALARM DEVICES: XENON STROBE LIGHTS.
E. REMOTE ANNUNCIATOR: ALPHANUMERIC DISPLAY SAME AS FIRE-ALARM CONTROL UNIT.
F. DIGITAL ALARM COMMUNICATOR TRANSMITTER: FOR TRANSMISSION OF FIRE-ALARM, SUPERVISORY, AND TROUBLE SIGNALS TO A REMOTE ALARM RECEIVING STATION OR ANOTHER REMOTE LOCATION BY MEANS OF TELEPHONE LINES.
2.5 TESTING: BY FIRE ALARM CONTRACTOR.

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CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: XX

ELECTRICAL SPECIFICATIONS

SHEET NO.: E0.02

PANEL SCHEDULE (EXISTING)

PANEL ID: PANEL 3C | VOLTAGE: 208/120V | BRANCH: NORMAL
LOCATION: ELECTRIC ROOM | PHASE: 3 PHASE, 4 WIRE | BUS TYPE: COPPER
FED FROM: EXISITNG | MAINS: NONE | NEUTRAL: 100%
MOUNTING: SURFACE | MAIN BUS: 400A | ISOLATED GND BUS: NO
ENCLOSURE: NEMA-1 | AIC: 10,000 | FEED THROUGH LUGS: NO

Circuit	Load Description	Load (VA)	Wire Size	Grd Size	Cond	Amps	Pole	A	B	C	Pole	Amps	Cond	Grd Size	Wire Size	Load (VA)	Load Description	Circuit
1	MEN & WOMEN TOILET LIGHTS	200	12	12	3/4	20	1	300			1	20	3/4	12	12	100	OFFICE/CORRIDOR LIGHTS	2
3	EXTERIOR LIGHT	100	12	12	3/4	20	1		300		1	20	3/4	12	12	200	DRINKING FOUNTAINS	4
5	OFFICE RECEPTACLES	130	12	12	3/4	20	1			630	1	20	3/4	12	12	500	CORRIDOR RECEPT.	6
7	WATER HEATER	18000	6	8	1	65	3	18230			1	20	3/4	10	10	230	MENS TOILET HEAT	8
9	-	18000	6	-	-	-	-		18230		1	20	3/4	10	10	230	WOMENS TOILET HEAT	10
11	-	18000	6	-	-	-	-			18500	1	20	3/4	12	12	500	INTAKE & EXHAUST FANS	12
13	CORRIDOR HEAT	150	12	12	3/4	20	1	1350			1	15	3/4	12	12	1200	◆ MINI-SPLIT SYSTEM	14
15	MEN'S TOILET HAND DRYER #1	1725	12	12	3/4	20	1		1725		1	-	-	-	-	-	-	16
17	MEN'S TOILET HAND DRYER #2	1725	12	12	3/4	20	1			3450	1	20	3/4	12	12	1725	WOMEN'S TOILET HAND DRY. #1	18
19	SPARE		-	-	-	20	1	1725			1	20	3/4	12	12	1725	WOMEN'S TOILET HAND DRY. #2	20
21	SPARE		-	-	-	20	1		0		1	20	-	-	-		SPARE	22
23	SPARE		-	-	-	20	1			0	1	20	-	-	-		SPARE	24
25	SPARE		-	-	-	20	1	0			1	20	-	-	-		SPARE	26
27	SPARE		-	-	-	20	1		0		1	20	-	-	-		SPARE	28
29	SPARE		-	-	-	20	1			0	1	20	-	-	-		SPARE	30
31	SPARE		-	-	-	20	1	0			1	20	-	-	-		SPARE	32
33	SPARE		-	-	-	20	1		0		1	20	-	-	-		SPARE	34
35	SPARE		-	-	-	20	1			0	1	20	-	-	-		SPARE	36
37	SPARE		-	-	-	20	1	0			1	20	-	-	-		SPARE	38
39	SPARE		-	-	-	20	1		0		1	20	-	-	-		SPARE	40
41	SPARE		-	-	-	20	1			0	1	20	-	-	-		SPARE	42

BASIS OF DESIGN: SQUARE-D NQOB (208/120V) AND SQUARE-D NF (480/277V)
◆ HACR BREAKER

	CONNECTED LOAD (VA) A	B	C	DEMAND FACTOR	DEMAND LOAD (VA) A	B	C
LIGHTING:	300	100	0	1.25	375	125	0
RECEPTACLES (TOTAL):	0	200	630	0.00	0	0	0
RECEPTACLES (1ST 10 KVA):	0	200	630	1.00	0	200	630
RECEPTACLES (REMAINDER):	0	0	0	0.50	0	0	0
LARGEST MOTOR LOAD:	0	0	0	1.25	0	0	0
REMAINING HVAC LOADS:	21305	19955	21950	1.00	21305	19955	21950
MISCELLANEOUS:	0	0	0	1.00	0	0	0
KITCHEN EQUIPMENT:	0	0	0	1.00	0	0	0
SUBTOTAL:	21605	20255	22580		21680	20280	22580

TOTAL CONNECTED LOAD: 64.4 KVA
TOTAL CONNECTED AMP./PHASE: 180.0 | 168.8 | 188.2 A

TOTAL DEMAND LOAD: 64.5 KVA
TOTAL DEMAND AMP./PHASE: 180.7 | 169.0 | 188.2 A

LIGHTING FIXTURE SCHEDULE

MARK	MANUFACTURER	CATALOG #	DESCRIPTION	MOUNTING	LAMPS NO.	LAMPS TYPE	VOLTAGE	REMARKS
A1	LITHONIA LIGHTING	STL4-20L-EZ1-LP840	1FT X 4FT SURFACE	SURFACE	9	LED INCLUDED WITH FIXTURE	120/277	WHITE FINISH W/ ACRYLIC LENS
A2	LITHONIA LIGHTING	W-2-32-MVOLT-AE	4FT VANITY	SURFACE	4	32 WATT T8 LAMP	120/277	WHITE FINISH W/ ACRYLIC LENS
A3	LITHONIA LIGHTING	REAL6C-D6MW-ESL-1500L-35K-.95SC-120-LP6LN-PFMW	6 INCH DOWNLIGHT	RECESSED	1	LED INCLUDED WITH FIXTURE	120	MATTE WHITE PLASTIC FLANGE RING
E1	LITHONIA LIGHTING	EU2-LED-M12	EMERGENCY LIGHT	SURFACE	3	LED INCLUDED WITH FIXTURE	120/277	WHITE PLASTIC HOUSING
W1	LITHONIA LIGHTING	TWR1-LED-2-50K-MVOLT-PE	EXTERIOR WALL LUMINAIRE	SURFACE	1	LED INCLUDED WITH FIXTURE	120/277	DARK BRONZE FINISH
X1	LITHONIA LIGHTING	ECR-LED-M6	EXIT SIGN	SURFACE	1	LED INCLUDED WITH FIXTURE	120/277	EXIT SIGN WITH EMERGENCY EGRESS LIGHTS

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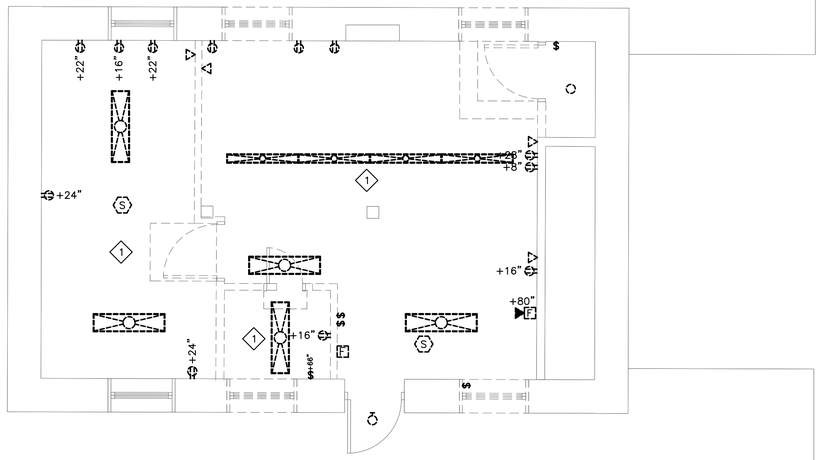
CONSTRUCTION DOCUMENTS

REVISIONS:

DATE: 05-17-2016
PROJECT NO: 10895-3
EXP./CLIENT NO: N/A
SCALE: XX

ELECTRICAL SCHEDULES

SHEET NO.:
E0.03



ELECTRICAL DEMOLITION PLAN

SCALE: 1/4" = 1'-0"

GENERAL NOTES

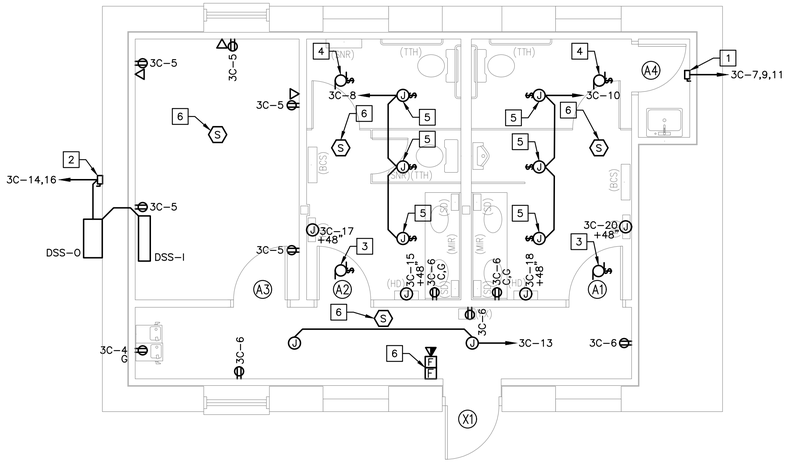
1. COORDINATE EXISTING PANEL TO BE UTILIZED WITH OWNER. PANEL SCHEDULE AND CIRCUITS ARE SHOWN FOR DESIGN PURPOSES.

◇ DEMOLITION NOTES

1. REMOVE ALL EXISTING ELECTRICAL AND DATA DEVICES WITHIN RENOVATION AREA.

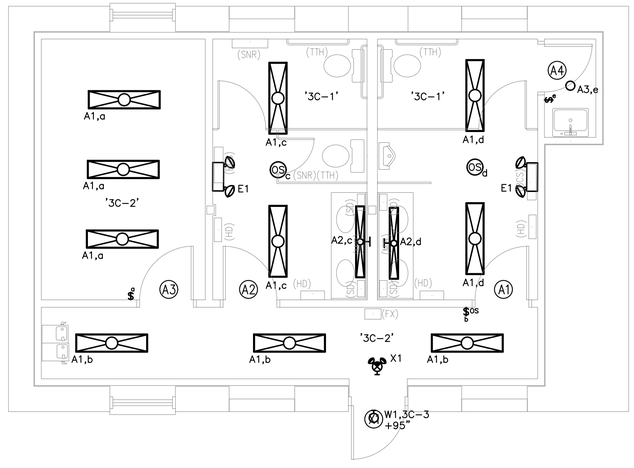
□ CONSTRUCTION NOTES

1. DISCONNECT: 100A, 240V, 3ø FOR WATER HEATER.
2. DISCONNECT: 30A, 240V, 1ø FOR MINI-SPLIT UNIT.
3. INTAKE FAN: 0.06HP, 0.43A, 115V, 1ø WIRED TO ROOM OCCUPANCY SENSOR. PROVIDE TOGGLE SWITCH DISCONNECT AT EACH FAN.
4. EXHAUST FAN: 0.06HP, 0.43A, 115V, 1ø WIRED TO ROOM OCCUPANCY SENSOR. PROVIDE TOGGLE SWITCH DISCONNECT AT EACH FAN.
5. INSTALL JUNCTION BOX TO SERVE RADIANT HEATING PANEL. PROVIDE TOGGLE SWITCH DISCONNECT AT EACH RADIANT HEATING PANEL.
6. CONNECT NEW SMOKE DETECTORS, PULL STATION, AND STROBE INTO EXISTING FIRE ALARM SYSTEM.



ELECTRICAL POWER PLAN

SCALE: 1/4" = 1'-0"



ELECTRICAL LIGHTING PLAN

SCALE: 1/4" = 1'-0"

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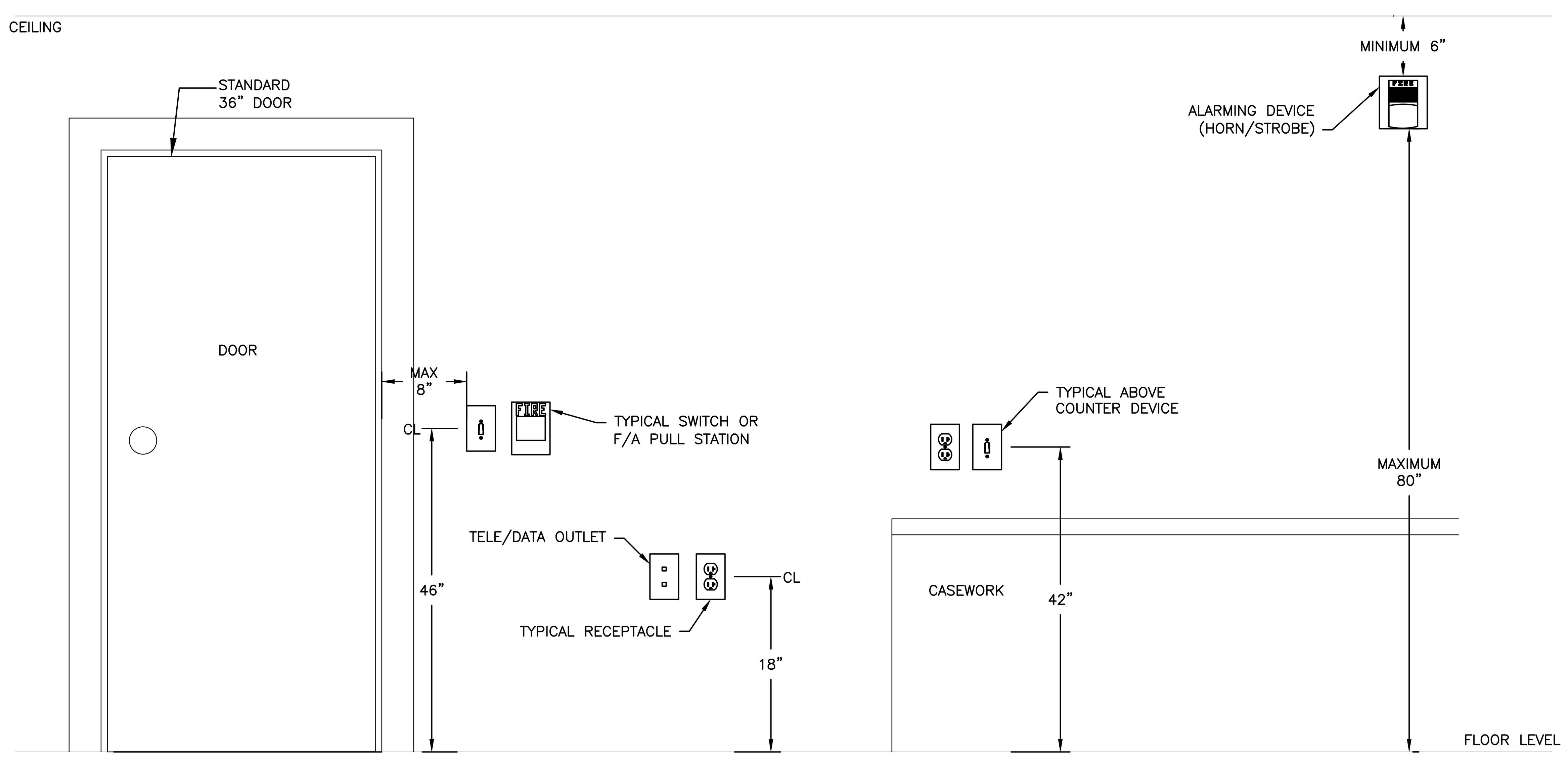
SCALE: 1/4" = 1'-0"

ELECTRICAL PLAN

SHEET NO.:
E1.01

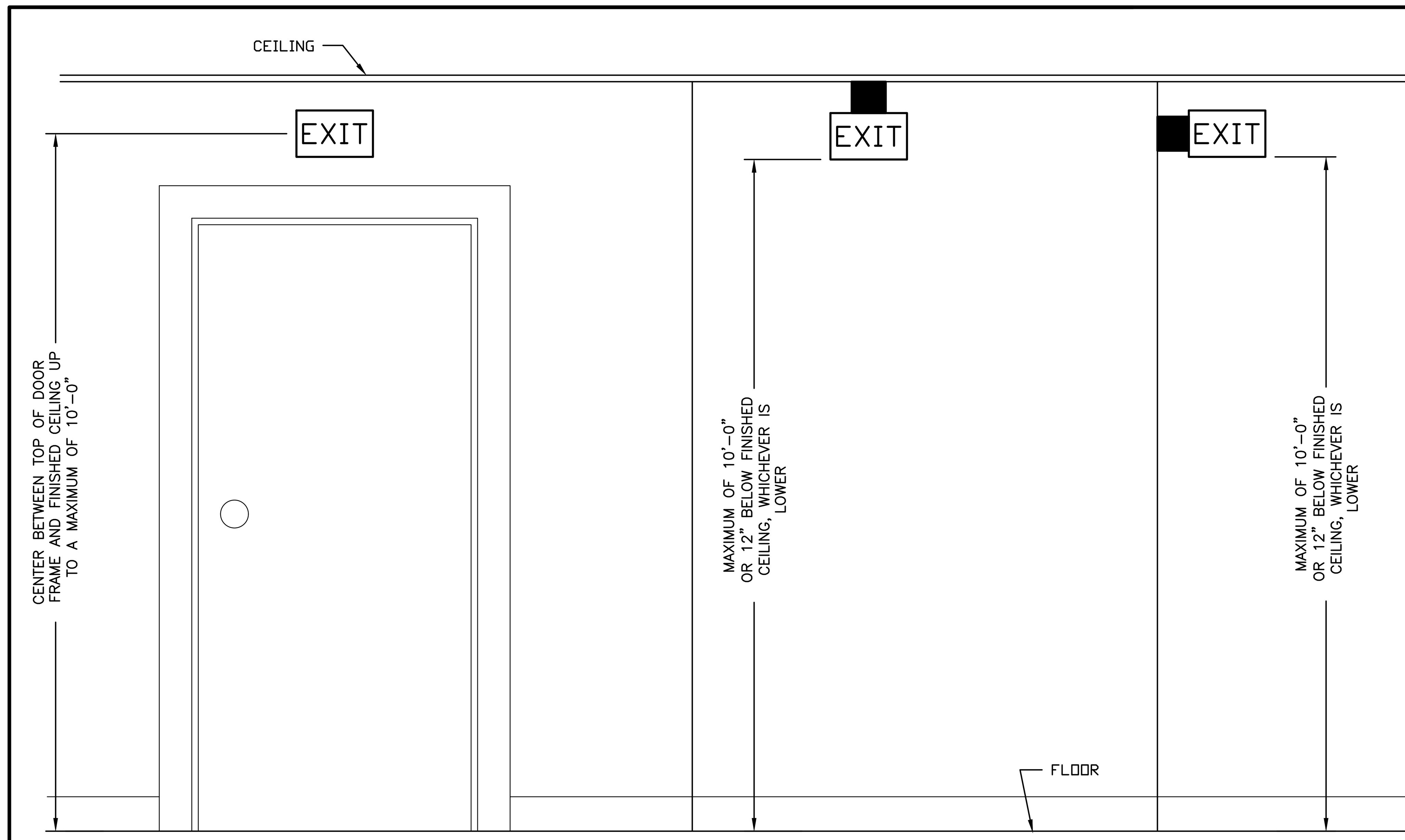


NOTE:

COORDINATE ALL DEVICE MOUNTING LOCATIONS WITH WALL FINISHES, ARCHITECTURAL ELEMENTS, AND CASEWORK ELEVATION BEFORE INSTALLATION. IN RENOVATION PROJECTS, DEVICE HEIGHTS SHALL MATCH THE BUILDING STANDARD IF CODE ALLOWS.

ELECTRICAL DEVICE MOUNTING HEIGHT DETAIL

NOT TO SCALE

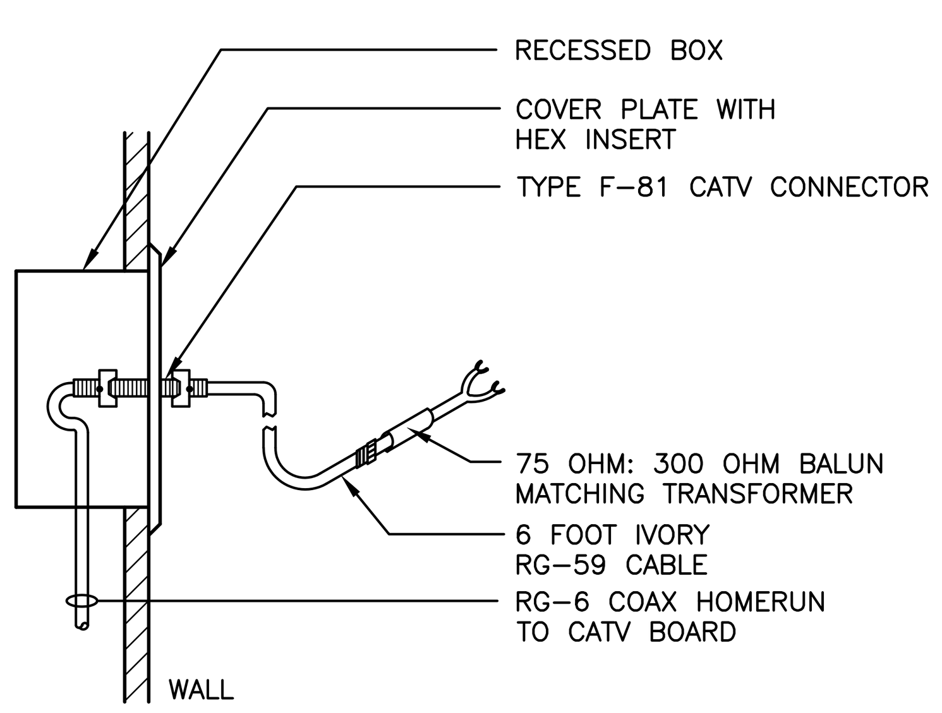


NOTES:

1. ABSOLUTE MINIMUM MOUNTING HEIGHT OF EXIT SIGNS SHALL BE 88 INCHES TO BOTTOM OF SIGN.

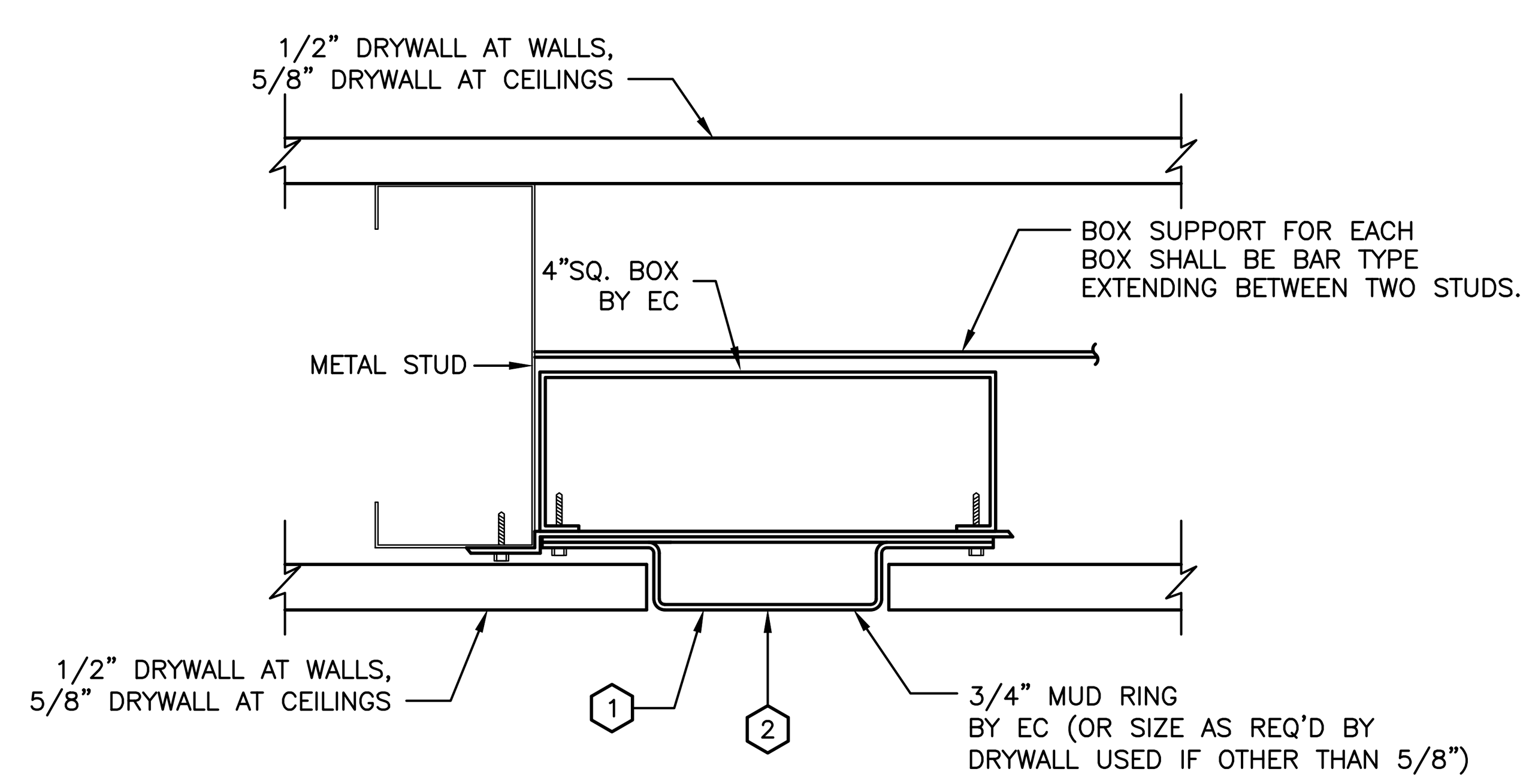
EXIT SIGN MOUNTING DETAIL

NOT TO SCALE



(TV) CATV OUTLET DETAIL

NOT TO SCALE

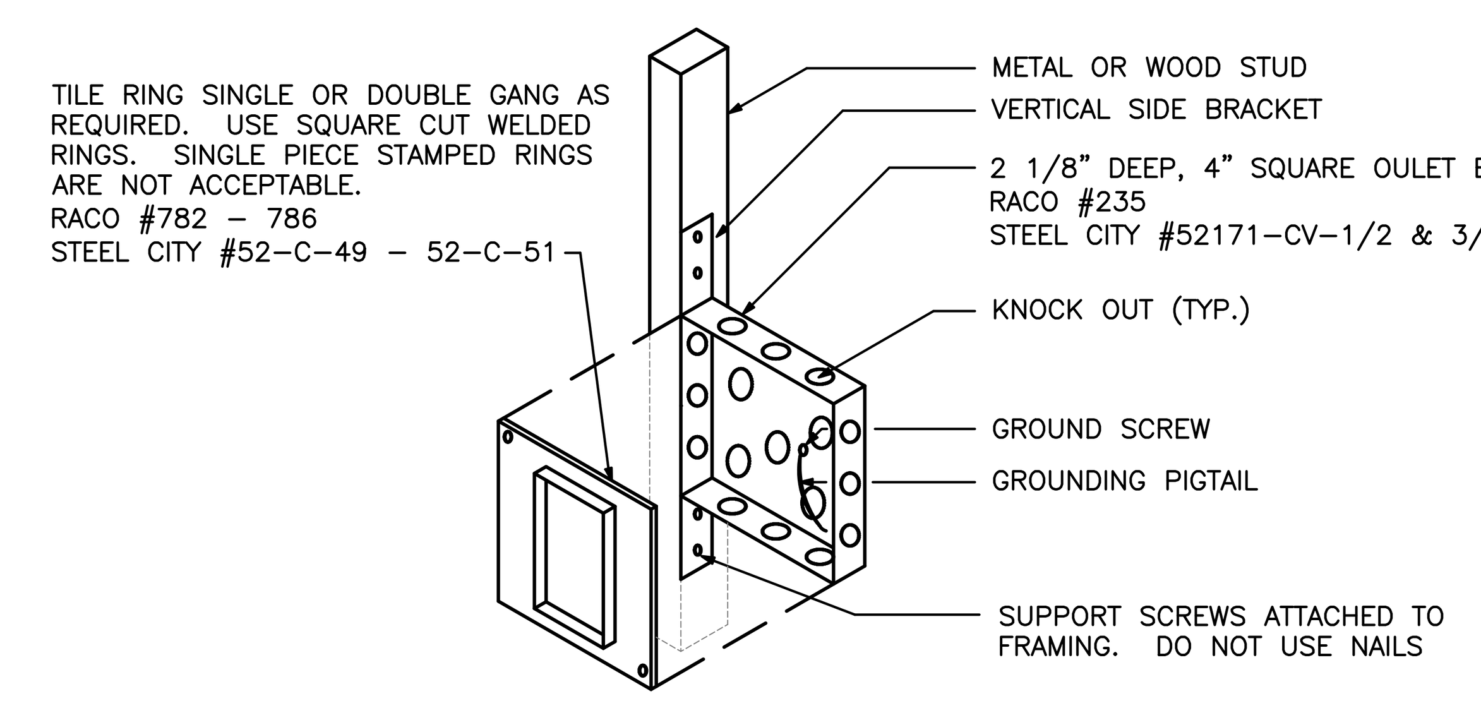


PLAN VIEW

1. USE MUD RING 1/8" DEEPER THAN DRYWALL THICKNESS TO ASSURE MUD RING IS FLUSH WITH FACE OF DRYWALL. EC IS RESPONSIBLE FOR MUD RING FLUSH WITH DRYWALL AND SHALL BE RESPONSIBLE TO PAY DRYWALL CONTRACTOR TO REDO DRYWALL WALLS IF OUTLET BOX INSTALLATION IS NOT CORRECT AND MUD RING IS NOT FLUSH.
2. PROVIDE CADDY 'RC' CLIP FOR ALL OUTLET BOXES.

DRYWALL OUTLET BOX INSTALLATION DETAIL

NOT TO SCALE



FLUSH OUTLET BOX DETAIL IN METAL OR WOOD FRAMING

NOT TO SCALE — *1 TO 2 GANG*

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SCALE: XX

ELECTRICAL DETAILS

SHEET NO.: E4.01